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Advertisement Index, see page xliv.

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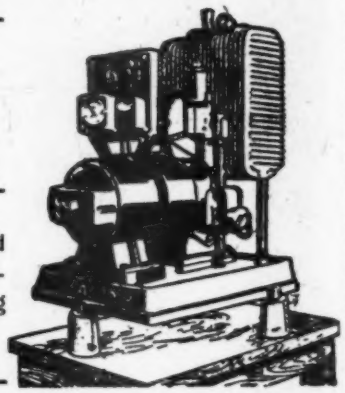

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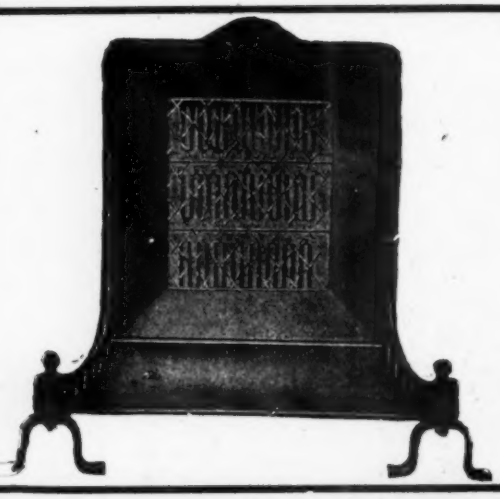

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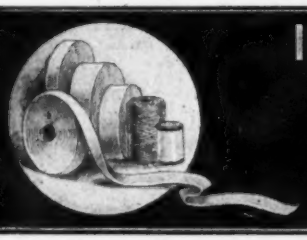

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Vol. LXXXIX.] CONTENTS: August 12th, 1921. [No. 2,281.

	Page
Assets Taken on Trust	201
The Electro-Harmonic Society	202
Profit and Loss	202
The E.T.U. and Non-Union Labour	203
Representation of Labour on London Joint Electricity Authority	203
Imperial Communications	203
Automatic Lighting Sets, by H. R. Taunton	204
The Duty of Those Who Supply Electrical Fittings	205
Electricity District Inquiry Procedure	206
Electric Arc Welding in the Manufacture of New Boilers	208
Conditions in Spain	209
Electricity Supply Administration	209
New Electrical Devices, Fittings, and Plant (*illus.*)	210
Correspondence—	
Oil Consumption and Prices	211
Testing and Repairing Magnetos	211
Leeds Electrical Training Centre	211
Battery Explosions	211
The Faraday Society	212
Business Notes	213
Notes	219
City Notes	222
Stocks and Shares	223
Market Quotations	224
The Incorporated Municipal Electrical Association (*concluded*)	
Commercial Problems in Electricity Supply, by E. Cross	225
The Engineering Conference, 1921 (*continued*)	
Steam *versus* Electric Winding, by W. C. Mountain	228
The Utilisation of Exhaust Steam in Turbines, by M. Deacon	228
Damage to Tires and Rails caused by Brakes or Slipping Wheels, by C. P. Sandberg	229
Joint Electricity Authorities	230
Legal	231
New Patents Applied for, 1921	232
Abstracts of Published Specifications	232
Contractors' Column	Advertisement page xxx

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ASSETS TAKEN ON TRUST.

IT has been established, and in our opinion well established, that the business of an auditor is to ascertain the true financial position of a company and to see that it is stated in the accounts submitted to its members; and that his duty ends there.

He is to ascertain such position not merely by examination of the books and documents constituting direct and indirect evidence, but also by due inquiry, and by seeing that the books themselves indicate the true position. He is not in any respect a final guarantor of the accuracy of the accounts, but what is most important, he is to exercise reasonable care and skill in the performance of his duties, and what is reasonable care and skill is a matter depending on the particular circumstances of any given case. He is not liable for not tracking out ingenious and carefully-laid schemes of fraud when there is nothing to arouse suspicion, and when such frauds are perpetrated by tried servants of the company and are undetected for years by the directors. To hold the contrary would make the position of an auditor intolerable.

An auditor is not bound to be a detective or to approach his work with suspicion or with the foregone conclusion that there is something wrong. He is a watch-dog, but not a blood-hound. He is justified in believing tried servants of the company in whom confidence is placed by the company. If, however, there is anything to arouse suspicion he is to probe it to the bottom.

Such are some of the delivered legal *obiter dicta* with regard to the duty and responsibility of the auditor of a company.

In an article in *The Times*, a writer, who evidently takes as his text the recent bank failure, and who would convert most of the foregoing negatives into positives, and thus create a kind of prescient and omniscient man, states *inter alia* that "the directors have to show cash balances; assets other than cash balances and liabilities. The audit as regards cash is invariably real and searching and the balances are traced and vouched. But the statutory audit as regards assets is a farce, because the auditors are allowed to take from the directors any figures the latter choose to give them." The first part of the quotation indicates the mind of an amâteur, and the concluding part is worse than gross hyperbole. He continues: "It is no part of an auditor's duty to take stock, indeed in the ordinary case he would not be qualified to do so." Here he is on safe ground, and he ought to have added, among *other* things, that an auditor was not necessarily an expert or an authority on matters involving depreciation and valuation. A varying degree of trust is inherent in the audit of large undertakings. Particularly is this dependence unavoidable in manufacturing undertakings producing and carrying a large and varied assortment of stock-in-trade and conversion stocks, and all that can be demanded of the auditor is the exercise of reasonable care and skill in spite of the fulminations of the *Times* correspondent. In such cases the stock is taken, checked, and valued by the staff, under the instructions of the executive head. Everything in the record that can be authenticated is similarly performed, adequately certified, and approved by the board. The auditor's duty is to examine such record as far as he thinks it necessary in the circumstances. He ascertains the principle or mode of valuation adopted; he may refer to the cost accounts and invoices of the business, and take other steps which it is impossible for us to observe here in the course of a short comment. The writing-up of assets, whether fixed or

floating, is not difficult to trace, and the nature or composition of additions to such specific assets as plant, machinery, and buildings, is readily ascertainable by the auditor. Where, in so far as they can be or are installed, there may be found varying systems of internal check and internal audit necessarily conducted by special members of the staff of the company, the auditor may not be so rigorous in the procedure of his work as he would be in cases where such safeguards are absent, yet he will not fail to apply all reasonable and necessary tests. All auditors have their limitations. The velocity of human evolution, however, is so marked that before long we may arrive at the type of superman required, who will not be able to make an error even if he works to do so, and whose opinions of a business, which he does not know how to conduct, will be more valuable than the knowledge and ability of those who administer it.

So far as the duty of the directors and of the staff of trading and manufacturing companies is concerned, the valuation of electrical goods stocks is a matter of supreme importance in these days of changing prices. During periods of manufacturing inactivity stocks may be disposed of profitably, but with full production in progress and prices on the down-grade, it is possible to leave sources of serious weakness for later balance sheets, unless goods in store are written down to a reasonable figure, governed by actual costs, current suitability of the articles themselves, the state of the trade or market, and so forth. These are matters falling within the purview of staffs and officials with more or less specialised technical knowledge of the trade with which they are concerned. The peculiar times through which we are now passing throw a heavy duty and responsibility upon such men. They must know quite well that companies or firms which fail to reduce book values to figures corresponding to actual market values, may repeat, with disastrous consequences, the mistakes, which have been some of the outstanding causes of downfall in trade and industry in the past.

The Electro-Harmonic Society.

Members of the Electro-Harmonic Society who read the report recently issued by the Executive Committee will be aware that the statement of accounts for the 1920-21 season showed a deficiency of £23 11s., the expenses having exceeded the receipts by that amount. To reduce expenses in these days so as to bring them within the limits of the income is impossible if the high standard of the past is to be maintained. The only alternative, therefore, is to raise the annual subscription, which as the Executive points out in the report, has until now remained at its pre-war level of 10s. 6d. It is our belief that members will at once recognise the necessity for an increase. Certainly we feel that many of them will learn with astonishment that 10s. 6d. was the subscription rate for the first season of the Society thirty-five years ago, and that it has remained unchanged until now! When the half-guinea was first introduced it was only intended to cover the cost of four concerts held between January and April. The Society was then able to carry on at small expense, for there were many amateurs among the members who gladly rendered most acceptable service. We well recall that their number included Messrs. T. E. Gatehouse, James Swinburne, E. C. de Segundo, Alexander Siemens, J. E. Kingsbury, and several ladies, notably Mrs. Alexander Siemens. Some of these have passed beyond the call of the Committee, or prefer the less prominent place desired by those of a retiring disposition. In addition to this, as years passed by, the concerts became more elaborate, artistes' fees were higher, larger rent had to be paid for the concert hall, the cost of printing increased, and all these things have combined to make inevitable the advance which is now proposed, if, as we say, the musical entertainment is to be maintained at a high standard and is to be as enjoyable as in the past.

It may be feared that some members will withdraw from membership, but there will be few who will so fail to see the value of fraternising under E.H. conditions six times in the season, as to retire because an extra half-guinea has to be paid. But if there should be withdrawals, that fact alone is a reason for making the increase sufficient to cover any loss of revenue due thereto. That there must be some increase is undisputed—members will not desire the Society to run at a loss; and in all probability those who withdraw for 10s. 6d. would do so if the advance were less than that sum. It is very desirable, in order to give the general body of the membership a series of really good concerts in future seasons, that the Society should be put on to a stable financial basis. The new subscription rate (21s.) should bring about that result.

Profit and Loss.

The statement issued by the directors of Fuller's United Electric Works, Ltd., which we publish in our financial pages to-day, will be read with regret, and may we add, sympathy. A year ago the directors were able to recommend dividends of 10 per cent. on both the ordinary and the preference shares. Extended manufacturing facilities had only just been completed, and the capital laid out thereon was expected to yield results in the then approaching year; indeed, the "rapidly increasing business and the higher cost of stocks" made it necessary to proceed to raise further capital which the directors were of opinion could be "profitably employed." The report to this effect appeared in the Electrical Review for July 16th, 1920. In addressing the annual meeting on July 14th, the chairman said he was "filled with optimism," and he foresaw that the demand for electrical material would increase by leaps and bounds and fortunes would be made. The limit to the company's output would be fixed only by the amount they could produce. They had more orders than ever before in their history, and their output of manufactured goods was more than double what it was a year earlier. On July 26th the issue of £200,000 short term notes was made for the purpose of repaying the bankers' loan (£165,320) and providing further working capital. The profit for the year ended March, 1920, was £48,045. A year later the accounts show a loss of £129,048. There is not within our memory a case of any electrical manufacturing company suffering either so rapid a change in its fortunes or so great a loss in any one year. But during the last few years we have become accustomed to large turnovers, high prices, big capital, and big profits. Operations have been on an unprecedented scale, and great opportunities have appeared to be opening out for those who were prepared to show a spirit of enterprise in taking advantage of them. But while all these things have been on the grand scale, we have also been up against the most serious conditions that have ever faced industry, and the company now under consideration has, by reason of the special class and character of its products and the materials employed therein, as well as by "unrestricted competition" (carbons), been heavily beaten about by the tempest that has raged. The hopes of July, 1920, were followed almost immediately by the motor trade slump of August, and the effect of that and the series of adverse influences all became concentrated in the brief period of the following seven months, with the unfortunate result now reported.

Happily, we are writing at a time when some of the depressing conditions have passed away, leaving occasion to anticipate a much better state of things. It may be that even while the return to normal conditions is in progress other concerns may have to divulge unfortunate experiences, but this need not mean that there is any reason for being pessimistic in regard to the future of British electrical industry. We live in times when it is very easy indeed for conditions to get beyond control, especially in an expanding business. The directors of Fuller's have been wise to write down stocks to meet changing prices and conditions and to

write down capital to meet the loss so far incurred. This has been done by reducing the value of the ordinary shares from £1 to 4s. each, and the desire to do the right thing is indicated by the circumstance that this class of share is held mainly (as to two-thirds of the whole) in the family circle. The company has been passing through an industrial and trade storm of unprecedented violence, and we wish it well in the efforts it is making to weather the gale.

The E.T.U. and Non-union Labour.

The attitude recently taken up by the E.T.U. with regard to the connecting-up of installations carried out by non-union labour has entered upon a new phase which opens up possibilities of a startling character. Not content with the original policy, which at least had its limits, the London branch of the E.T.U. has decreed that, even if an electrical installation at a kinema or theatre is executed by members of the Union, that installation shall not be connected to the supply mains if the men employed in the building are not trade unionists. As a result, the Stepney Corporation is threatened with legal proceedings for non-compliance with the terms of its electricity Order, and all it can do is to instruct its engineer to give orders for the connections to be made. Unless the members of the E.T.U. concerned ignore the orders of their Executive, it would appear that the result of such an instruction will be nothing. The Union maintains that a fundamental principle of trade unionism is involved, but this is very unlikely to succeed as a plea in the Council's defence.

It is an avowed object of the E.T.U. to secure control of the industry, but if this means the control of everything connected with the industry in any way whatever, the success of the Union's policy would bring an "electrical era" of a kind very different from that usually implied by the term. It seems to be a cardinal feature of that policy to meddle with someone else's affairs, and to produce discord where harmony reigns. But sooner or later the meddler burns his fingers—or gets an electric shock—and the E.T.U. London Executive will one day have its lesson.

Representation of Labour on London Joint Electricity Authority.

The Electricity Commissioners at the London inquiry gave very full opportunity for the E.T.U. to put forward its views as to representation on the Joint Electricity Authority for London, if formed. As we have already indicated in our columns, the question of giving representation is not one which should be lightly entered into. This need of serious consideration is especially important seeing that the constitution of the various Joint Electricity Authorities in different parts of the country will probably vary very much, and include very varying powers. In some cases the Authorities will probably have very few direct employés and very limited scope of operation. In other cases the Electricity Authorities' operations may cover "control" of existing undertakings in their areas. Labour representation on an Authority such as the latter would therefore mean introducing quite a new feature into the Joint Electricity Authority's operations, since the control would obviously, in a sense, extend to the domestic labour arrangements of the individual undertakings. If the labour representation were limited to representing merely the workers who were directly employed by the Joint Electricity Authority, this would be one thing, but if they are to represent all the workers in the industry in the area, this is another matter altogether. The latter would mean that all labour grievances of the area could be brought before the Joint Electricity Authority, and it is difficult to see how in such case the Joint Electricity Authority can avoid becoming a general arbiter for the settlement of all the labour troubles of the district. That this would be the case was, we think, indicated by the evidence given by Mr. Webb before the Commissioners. One of the chief reasons why the Electrical Trades Union wished to be represented on the Joint Electricity Authority was that at present there are no statutory powers enforcing the decisions of the Whitley Councils on the employers. It is evident, therefore, that from the Trade-Union point of view the Joint Electricity Authority would be looked upon as a body whose task it would be to enforce all wages agreements upon the undertakings in its area. The complexity and difficulty of such a function is obvious. It is in no antagonistic spirit to the claims of labour that we make these criticisms. We have always strongly supported the Whitley Councils as giving labour a proper voice in the industry, and we have nothing but condemnation for undertakings which do not carry out the decisions of District Councils. We are at one with Mr. Webb in his deprecation of agreements not being carried out, but we do consider that a Joint Electricity Authority, by its constitution and functions, is not a proper body to have to deal with such matters.

Imperial Communications.

The imperative need for prompt and easy communication between all parts of the Empire, but above all between the Home Country and the Dominions, has often been emphasised in our columns; we have urged that rates should be lowered and facilities increased as fully as possible, not only in the interests of trade, important as those are, but also in the interests of the Empire as an organic whole. The sea which separates the component parts of the Empire is at the same time the most effective bond between them, for it facilitates the direct transport of goods and persons, and affords a safe shelter for that wonderful network of submarine cables which has so magnificently served the needs of speedy communication in the past, and will continue to do so in the future. But these ways and means are still inadequate to fill unaided all requirements, and while the airship has been invoked to accelerate oversea transit, the wireless telegraph is needed to supplement the cable service. We look upon the development of the Imperial wireless chain, therefore, with the greatest interest and solicitude, earnestly hoping that the time will soon come when all parts of the Empire will be provided with efficient long-distance wireless stations.

The subject necessarily came up for discussion at the recent Conference of Prime Ministers, which adopted a scheme proposed by the Imperial Wireless Telegraphy Committee. It is reported that the Australian Commonwealth has withdrawn from participation in the Imperial Wireless Chain, on the ground that there is no need for intermediate repeating stations, and that direct communication with the Antipodes is feasible; that may be the case, but whether it is commercially practicable is another question, and surely Australia would benefit more by the immediate extension of her means of communication through the Chain than by waiting until antipodal transmission is established on a sound workaday basis. Canada, South Africa, and New Zealand are also omitted from the scheme, which therefore is only nominally "Imperial." In the meantime, other countries are going ahead with their own systems, while the British Imperial Chain has made but little progress—not even the Home stations have as yet been completed by the Post Office, which is in charge of the system. It was recently stated in the Press that even in China a Marconi temporary station was receiving almost daily messages from the Marconi station in Cornwall—yet the British Government, which tackled the subject ten years ago, has not yet a single commercial wireless service overseas. The fact is that the Government is the very last authority that should be permitted by the nation to embark upon an undertaking of this kind, which, if it had been left to private enterprise, would probably have been in operation before the war.

AUTOMATIC LIGHTING SETS.

By H. R. TAUNTON.

One of the most striking features of post-war electric lighting development has been the large and ever-increasing number of electric lighting sets put upon the market, as witness the advertising pages of the Review. Practically all embody automatic features; and they can be divided into two classes—full-automatic, and semi-automatic, the latter largely preponderating.

The essential principle of the full-automatic set is that it starts up automatically under certain predetermined conditions, and shuts down in the same way when it is no longer required—an admirable object lesson to Government departments! Probably the best example of this class, and the best known—a pre-war pioneer—is the . . . But it will be better to avoid names, as otherwise it may prove difficult to steer between the Scylla of gratuitous advertisement, and the Charybdis of libellous criticism. Besides, one would have to mention them all, in fairness, and that would fill an issue of the Review. The example referred to is standardised in a large range of sizes, up to comparatively large capacities, in both direct-coupled and belt-driven sets. It has an independent switchboard, and a battery of small capacity, floating across the mains. This supplies current when only a few lamps are in use. When the number of lamps alight reaches the limit for which the relay on the switchboard is set, the battery supplies the necessary current, through a special controller, to the suitably wound generator, motoring it to start up the engine. Compression is released by valve lifters actuated from the controller, until the engine picks up the load. When, later, the number of lights is again reduced to the limit, the relay comes out, the generator is cut out of circuit, and the battery again takes up the supply. The same general features are common to all full-automatic sets.

The champions of this type of lighting set claim, of course, as an outstanding advantage, that nothing is required of the attendant (who may be as ignorant and unskilled as you please) while the set is in actual operation. It can in theory be left to its own devices for days together, starting and stopping according to the number of lamps in use in the distant house. And this advantage is the only one they *can* claim over the semi-automatic sets, which need the presence of the attendant at starting up. Against this one advantage—at best a very unsubstantial one—must be set a number of inherent disadvantages.

The supposed advantage we will analyse later—now for the disadvantages. Unless running on town's gas, they have to run continuously on petrol, as an automatic change over to paraffin is difficult—almost impossible. This, even in a small set, is a consideration; and in large sets it is a serious one. Using a battery of small capacity, the sets must be adjusted to start up whenever a relatively small number of lamps are in circuit, which means that they are running most of the time at low efficiency. As the batteries are at approximately the same voltage as the generators during normal running, they have to receive a topping-up charge periodically. This is apt to be neglected, the attendant—by hypothesis, ignorant and unskilled—being instinctively biased in his neglect by the words "fully automatic." As a result, the batteries generally get into very poor condition. If, through some slight mischance or defect, the engine refuses to fire, or is stiff or difficult, excessive current is taken from the battery. Flickering is apt to occur unless the engines are in perfect condition. Finally, to obtain the full-automatic features entails a complex switchgear with relays and controllers, solenoids and resistances galore. Hence trouble, and trouble necessarily beyond the competence of the poor, ignorant attendant.

If the set is well designed and made, as in the example referred to above, the possibility of trouble may be minimised, but it is obviously more apt to occur than with the simpler semi-automatics; and when it does, it is, for the same reason, more apt to be beyond the powers of the attendant, or even the local plumber.

In one American set, still almost unknown in this country, the switchboard, although fully automatic, has been simplified practically down to the level of the usual semi-automatic control. As the makers claim, too, that they have—they certainly have experimentally—overcome the difficulty of changing over from petrol to paraffin at starting, they would appear to have a set which may prove a serious competitor of the semi-automatics.

These undoubtedly hold the market at present. There are a dozen different makes available for every one of the full-automatics. Compact, simple, and economical, they meet a general want, and their field becomes wider every day, as their advantages become known. It is no exaggeration to say that thousands of householders who have had these sets installed during the last few years would still have been using oil and candles if their only alternative had been the apparent complication of an ordinary electric lighting plant, and the seeming necessity of an expensive skilled man to run it.

Although they vary considerably in detail, all embody the same principle—of taking the normal supply from the battery, and charging up whenever it is convenient to run the engine; the automatic feature being that the engine is shut down, in the absence of the attendant, as soon as the battery is fully charged, generally through the medium of an ampere-hour meter. All of them, too, are arranged to start up, when the battery needs charging, by the movement of a switch, the specially wound generator taking current from the battery, and motoring the engine.

At present there are more American automatic sets on the market than British. Generally speaking, they are smaller—$\frac{3}{4}$ kW is a favourite size—and less substantially built than their British competitors. There are exceptions on both sides, of course, but the average American set is obviously built on the same principle as their cars—good service for a short time at a low first cost—then the scrap heap, to make way for an improved model. One very widely advertised model has a cylinder about the size of a half-pint tumbler, and is claimed to be capable of dealing with a 50-light installation. According to the makers, it has done it by the thousand in the States, so there is no obvious reason why it should not do it here. The average Englishman, however, likes to see plenty of metal for his money, even if it means his great-grandson being landed with a white elephant; and our makers usually cater for his taste.

The battery sold with American sets is also on the small side, judged by our standards. Their rating is certainly not the ten-hour rating, down to 1.83 volts per cell, usually adopted here. Their average 160-Ah battery is something more like what we would call 110 or 120 Ah. Some of the cheaper sets, indeed, have batteries which can only be rated on their "ignition" capacity.

Another feature of the American sets is that they are almost always standardised at 32 volts—a real drawback for the British market. Not only is it difficult to get 32-volt lamps from stock, but 32-volt accessories—irons, kettles, and so on—are almost impossible. Again, the low voltage entails increased wiring costs, a disadvantage even more marked in the case of the 25-volt sets marketed by some English makers.

One of the earliest of the American sets has its engine of $1\frac{1}{2}$ b.h.p. air-cooled, the radiating fins of the cylinder being enclosed in a sleeve through which air is forced by the flywheel fan, a principle which has several imitators. It does away with the slight complications of water cooling, and makes an efficient and compact ar-

rangement where small horse-powers only are concerned. The engine runs on paraffin, starting on petrol. Ignition is from the lighting battery. The dynamo—the usual 32-volt machine—is built up as an extension of the crank case. The switchboard is simple, and provides the standard features of semi-automatic control. The battery, of either 80 or 160 ampere-hour capacity, is generally supplied with sealed tops. The whole constitutes a workmanlike, and, within its limits, efficient set, at a very reasonable cost.

But it is rather like attempting to compare a "Ford" with a "Rolls-Royce" to compare such a set with a representative British example—with, for instance, the set associated with the names of two firms of aeroplane builders. As this particular set is typical of the best British standards, it will be interesting to describe it in detail.

To begin with, the engine is of 3 b.h.p., double the usual American size. This, while somewhat increasing its cost, widens the field of application enormously. Moreover, as it is fitted with a pulley in addition to an outside flywheel, it can be used—and the switchgear is arranged for its use—as a power unit to drive small domestic and farm machinery within its scope, such as a pump, a small saw for firewood, churn, chaff-cutter, pulper, and so on. It runs on paraffin, and is fitted with a simple but effective petrol starting device, with an automatic change-over, which effectually prevents crude paraffin being drawn into the combustion chamber, a source of much trouble in other sets. Water-cooling is adopted, with plenty of jacketing, and a detachable cylinder head. Ignition is by magneto, and it is by earthing the magneto by a contact on the ampere-hour meter when the battery is fully charged, that the set is automatically stopped. The magneto is also earthed, and the set stopped, if the lubricating oil in the sump falls below the minimum. For the rest, the engine is of standard four-cycle type, medium speed, vertical pattern, with the clean, simple lines and massive construction that characterise British-made internal-combustion engines.

The dynamo, which is built up on an extension of the main shaft, with an outer bearing, is of the usual series shunt wound type, 1½ kW, 50 volts, with a normal maximum output of 22 amperes at 70 volts when charging.

It is in the switchboard that this particular set outstrips its American competitors and, indeed, shows the way to its British ones. In the first place, it is totally enclosed, and this, combined with the fact that it has no porcelain parts—all insulation is mica on iron—and no copper strip contacts to work loose, makes it immune from accidental damage, and proof against vibration. The only external features are the dial of the ampere-hour meter and the two levers operating the rotary switches. These switches are of the lift-controller type, with shaped segments mounted on a cylinder and making contact, in different positions of the levers, for the various operations of starting, charging, running to lights, and so on. A valuable feature, and one that appears to be unique, is the provision made for cutting out the end cells of the battery if lights are in use while the battery is being charged. In most automatic sets there is no alternative to charging during daylight only, or over-running the lamps. In a 25 or 32-volt set, the over-running is perhaps not a serious matter, but in the standard 50-volt set it becomes an expensive drawback.

A battery of any make or capacity between about 75 Ah and 200 Ah can be used with this set, the engine governor being set for the normal charging rate.

Such a semi-automatic set—and the best of its competitors only differ from it in degree—has every advantage claimed for the full-automatic sets with the one exception that it will not start up automatically. And that advantage is, at best, a very shadowy one. The owner or attendant of a full-automatic set has to visit it from time to time to clean it, to oil it, to fill up the petrol tank. While he is doing that, is it so much trouble to press a switch, and start up the engine for a battery charge? Even if he does not visit the engine room for these purposes as often as is necessary to charge the battery, yet there are few who have sufficient faith in their full-automatic sets to keep them comfortable without a visit to the engine room either just before or immediately after starting up. So again, why not press a switch on the set, instead of in the house, and have done with it! For that is all it amounts to. So much for the claimed advantage. The attendant disadvantages we have already considered.

If one could have an automatic set with all the features of the almost ideal semi-automatic set alluded to above, with the following further advantages:—(*a*) Automatic starting, controlled not by the number of lights in use, but by the state of the battery. (*b*) Automatic change over from petrol to paraffin. (*c*) Automatic replenishment of the running supplies from large storage tanks of fuel and lubricant. And finally, complete enclosure from dust and dirt—then, indeed, we would have a really fully-automatic set, which could be left to its own devices for months at a time; until, in fact, it was necessary to decarbonise it. And if it could be produced at a price not exceeding that of the best semi-automatics, it would sweep the market.

At present, considering the types actually available, the verdict of this article, as between full-automatic and semi-automatic sets, is all in favour of the latter; a verdict which, to judge by the comparative numbers available and actually installed, is emphatically endorsed by the buying public.

THE DUTY OF THOSE WHO SUPPLY ELECTRICAL FITTINGS.

By A Legal Contributor.

An electrical contractor who sells and installs a fitting in the house of a private consumer is sometimes troubled to know the precise extent of his liability. A piece of electrical apparatus is not like a table or a chair which can be taken into and used in any house without any risk of danger to the house or its occupants. It can only be used in connection with and by means of the system already installed, which may consist in part of the mains of the supply company and in part of apparatus belonging to the consumer. The consumer probably knows very little about electricity. He has heard that an electric stove is *the* thing to have, and rushes off to buy one out of hand. What is the duty of the contractor who supplies it? There are, of course, certain obvious matters with regard to which he must be completely satisfied before he installs it and makes the necessary connections. But is it any part of his duty to inquire whether all the apparatus on the consumer's premises is in proper order and of sufficient capacity properly to work the stove?

The following is a type of case which will often occur in practice. A consumer buys a radiator, saying that he has a heating circuit in his house. All he asks is that an instrument of a stated kW capacity shall be supplied and connected up. The firm from which he buys makes no inquiry as to the capacity of the transformer. It turns out that the transformer (which belongs to the supply authority) is of insufficient capacity and is damaged. This painful fact is discovered by an inspector of the supply authority on his next visit. He reports the matter, and a bill for repairs is sent in to the consumer. Is he liable? Can he shift any part of his liability on to the electrical contractor? We have put the case of a radiator, but it is obvious that a similar question might arise in relation to other forms of electrical apparatus, *e.g.*, a carpet sweeper, a washing machine, or any other labour-saving device which the modern housewife, worried by the servant problem, is so eager to buy.

As to the liability of the consumer in the case above quoted, it may well be that the installation of a new

machine will necessarily involve an increased demand upon the mains, of which due notice should be given to the supply authority. The consumer's contract usually provides that such notice shall be given, and failure to comply with this provision may entail the supply being cut off. In these circumstances it will obviously be prudent for an electrical contractor to inquire of his customer whether such notice has been given; but we do not think that he is under any duty to make such inquiry, particularly in a case where (as in that above suggested) the premises are already provided with a heating circuit.

Whether notice be given or not it is conceived that if damage is done to apparatus of the supply authority, the consumer will be liable unless he can show that the damage arose through some defect in that apparatus for which he was not responsible. In the case suggested the overloading of a transformer would be a matter for which the consumer might be held responsible, and this although he had taken over that transformer, together with other apparatus of the supply authority, from a former tenant of the house. He could only escape liability by showing that the transformer was already damaged when he entered the premises.

It remains to consider whether he can pass on the liability to the electrical contractor. If it is the duty of an electrical contractor to examine *all* the existing apparatus on a consumer's premises in order to see whether it is sufficient and in good order, and, through his failure to discharge this duty, damage occurs, then he will be liable.

That he is under *some* duty to the consumer is reasonably plain. He is called in as an expert, and it is an implied term of his contract of sale that he shall supply apparatus which will work properly in the surroundings in which it is to be placed. He must do what is reasonably necessary in order to ensure that the article which he supplies is adapted to its purpose, and that the heating circuit is sufficient for the purpose. It is not easy to lay down definite rules as to what he should do in order to test the heating circuit. He might do enough if he were to satisfy himself, by looking at the ampere meter controlling the wall sockets, that it was safe to connect the radiator on that circuit. On the other hand, if it were considered by men of experience to be necessary to examine the transformer, it would be the duty of the contractor to examine that instrument in order to see that it would not be overstrained. As was indicated at the beginning of these notes, it must never be assumed that the consumer knows very much about electrical matters, and when he employs an electrical contractor he is entitled to rely on his skill and knowledge of the conditions under which any particular machine will work properly.

ELECTRICITY DISTRICT INQUIRY PROCEDURE.

Inevitably there will be—it is already beginning—an outcry that the expenditure for London only of seven weeks of the time of the Electricity Commissioners, a bevy of electrical engineers of the foremost rank and scale of fees, an even larger group of counsel and solicitors, and a number of other people who are mostly not at the inquiry for health or amusement, is an extravagant and wasteful expenditure of energy and cash. It may be admitted that the cash value of the inquiry will total up to some few tens of thousands of pounds. Whether the expenditure can be rightly classed as wasteful depends upon the result. *Primâ facie*, the achievement of the object of the inquiry, the provision of a cheaper and more abundant supply of electrical energy for the seven-odd million inhabitants of the delimited London district, approximately 20 per cent. of the population of the United Kingdom, is well worth a considerable expenditure in the preliminary survey. Such a survey should show the right way in which to solve the problem, and is likely to cost less than a method of trial and error which may result in much heavier fruitless expenditure, or equally expensive delays in arriving at the right solution. It seems to show some lack of a sense of proportion to condemn the proceeding simply because it costs a sum which, while large in itself, is a small fraction of the financial value of the possible benefits which may result.

But making full allowance for this view, it is a fair question whether the actual procedure adopted is either that best calculated to achieve the desired result, or the most economical way of arriving at it

The Ministry of Transport and the Electricity Commissioners have not, so far, seen fit to exercise the powers to make rules for the holding of these Electricity District inquiries which are given them by Section 34 of the Electricity (Supply) Act, 1919. Before the first inquiry was held, no one had any official guidance as to the form of procedure to be followed. Even now there is only the guidance of former inquiries, and if any dispute arises on a question of procedure it falls to the Commissioners then and there to settle it.

The disadvantage of this lack of guidance was shown in the very first inquiry, when Mr. Faraday Proctor, as the exponent of the only scheme put forward, was told by the Commissioners that he was at a great disadvantage in not having the assistance of counsel, though nothing in the Act or in any notice issued by the Commissioners requires that there shall be such assistance.

Apparently the Commissioners have preferred to allow procedure to develop under their guidance, rather than to give it a considered pre-determined form. They have, however, shown by their actions and utterances the kind of procedure which they consider desirable, and it is a fair criticism to say that to some onlookers the particular forms which they are shaping seem to be based on some misconceptions of their own position, of the position of parties who either submit or oppose schemes, and of the spirit of the Act.

Taking the course of the London inquiry, it may be said that the procedure adopted is modelled on that of Parliamentary Committees on Private Bills, with some reminders of that of civil courts.

The Commissioners are particularly solicitous to maintain a judicial attitude. On several occasions it has been said from the chair that the Commissioners have before them evidence to a certain effect, and that unless such evidence is countered by some on the other side they are bound to regard that evidence as a correct statement on the point at issue.

That, of course, is the correct attitude for a civil court, but not quite that for a Parliamentary Committee, which is entitled and bound to consider broad issues of public interest and policy, as well as the evidence tendered by the promoters and opponents of a private Bill.

But the Electricity Commissioners are not in the position either of a civil court or of a Parliamentary Committee. A civil court usually has to decide some dispute between litigants, on the facts established by the evidence tendered by the parties, applying to those facts and the arguments drawn from them by counsel, established principles of common and statutory law. In general the evidence it has to deal with is evidence of fact. There may be in some cases evidence of opinion and estimate, but this is always secondary to evidence of fact. The practice of cross-examination as developed in British courts of law is eminently successful in testing evidence of facts, including the memory and prepossessed notions of witnesses. It is not so satisfactory in testing evidence of opinion and estimates or forecasts of future events, in which the reputation and experience of the witnesses are important factors. Clearly the

Commissioners are not in the position of judges who have to decide a dispute between litigants.

Neither are they in the position of a Parliamentary Committee considering a private Bill, or a group of competitive Bills. A Parliamentary Committee has to decide in the first place whether or no the "preamble is proved." That is to say, whether the promoters of the Bill have made out a sufficiently good case in the public interests to justify Parliament in conferring upon them the statutory powers necessary to carry out their proposals. After deciding that the preamble is proved they have to consider whether and how interests that may be affected, private or public, have to be safeguarded by compensation and in other ways.

The Commissioners are not in that position. They have already by their notices under the Act decided that a certain area should be delimited as an electricity district, and that it is necessary that the organisation of electricity supply in that area should be improved. That is, they have declared the preamble proved. Further, they are not limited, as a Parliamentary Committee is limited, to considering the definite schemes put before them. They need adopt no such scheme. There may be no scheme put before them. They may themselves formulate a scheme, which may or may not embody the proposals of the schemes submitted. No Parliamentary Committee does this. It may, indeed, delete some physical features or some of the powers sought for in a private Bill, and to that extent may modify the promoters' proposals, but it cannot, or at least does not, turn the Bill presented for its consideration into an essentially different measure.

A Parliamentary Committee is a more or less expert body on the "practice of Parliament" on the extent and limitations of the powers which can be properly given to various classes of promoters, and it has available the expert advice of Speaker's counsel, other officers of Parliament, and reports from the Government Departments concerned. It is strong on questions of precedent and the public interest. But it is not expected to be, and generally is not a body of experts on the technical features of the particular Bill which it is considering. For this reason alone—and there are others—it does not attempt to turn a promoter's Bill into its own Bill, though it may modify its details.

The Electricity Commission, on the other hand, is a body of men highly qualified by special knowledge and experience not only to judge the merits of schemes submitted to it, but to prepare schemes itself, and it is its duty to do that in certain circumstances. It is hardly necessary to say that these qualifications cover the engineering, legal, financial, and administrative aspects of schemes for the better organisation of electricity supply. The Commission is so constituted as to be fully competent to exercise its own judgment as to the general form of such an organisation, the constitution and powers of the body which is to administer it, and the relationship which is to exist between that body and those already engaged in the electricity supply industry within the particular area under consideration. It has open to it all the official and published records relevant to the subject. It can obtain other information and evidence. Hence it is not correct to say that the Commission can only act on evidence formally laid before it. It is an expert body empowered to put before Parliament for confirmation the scheme it considers most likely to achieve the desired object in each case. It is bound to utilise the knowledge and experience of its own members in the formulation of these schemes.

It seems, therefore, that the procedure at the inquiries should be modelled to fit these facts. The question is what alterations should be made which are calculated to save time and money without any sacrifice of the clearness and fullness with which the cases of promoters and opponents of schemes are put before the Commissioners.

In the first place, it must be remembered that the necessity of some improvement in the organisation of electricity supply has already been decided upon by the Commissioners, who presumably will consider any schemes submitted to them from that point of view. Logically this would cut out any objections or proposals of a purely negative character, such as proposals from particular authorised undertakers that their areas of supply should be omitted from the operation of any scheme *because* they at least in their own territory have done and are prepared to do everything necessary. But as the inquiries cover proposals to vary the provisionally delimited area by either deletion or accretion, it may be difficult entirely to exclude pleas of this kind. The issues raised should, however, be narrowed. Pleas for exclusion from the delimited district because none of the schemes submitted promise any benefit to a particular area, are clearly misconceived. It is the duty of the Commissioners to formulate schemes which will benefit the whole of the areas included in the delimited district. It therefore seems that there should be some definition of the grounds upon which objections to the area of the district will be taken into consideration.

It would perhaps be too drastic to suggest that there should be any limitation to the representation of promoters and objectors by counsel and solicitors. Some counsel, it may be fully admitted, do help the Commissioners in various ways. Others seem to waste time. But it may be suggested that a great deal more would be gained than lost by a severe limitation of cross-examination by counsel. The Commissioners, it has been abundantly proved at the London inquiry, are very well able to examine witnesses themselves, and the demeanour and answers of witnesses to questions from the tribunal are markedly different from the answers given and demeanour shown towards "hostile" counsel. Much more helpful to the object of the inquiry too.

The fact is that there ought to be no question of hostility at all, and it seems to lie in the powers and rights of the Commissioners to make this clear at the outset.

There is, or there should be, only one object of all the parties, *i.e.*, to assist the Commissioners in devising a scheme which will improve the organisation for the supply of electricity in the district. Merely obstructive or negative utterances are out of place, and should not be allowed to take up much time. Discussions as to whether certain proposals in a scheme are *ultra vires* of the Act of 1919, or any other Act, seem particularly out of place. First, because the Commissioners with the legal and official advice open to them are most unlikely to submit, and Parliament is most unlikely to approve any scheme which conflicts with the 1919 Act, or the general and special law. Secondly, because any scheme approved by Parliament will "have effect as if enacted in" the Act of 1919 (Section 7 (2) E. (S.) Act, 1919). So that if it becomes virtually part of that Act, it cannot be *ultra vires* of it. There are quite a number of people, including the Commissioners, and the two Houses of Parliament, who will look out sharply that the Orders approved do not conflict with the main provisions of that Act, and such points should be left to them.

There is, however, another consideration which gives powerful support to the general plea for shortening the procedure and limiting the issues at these inquiries.

When the Commissioners have approved or themselves formulated a scheme, they have to publish it, and to hold a local inquiry thereon (E. (S.) Act, 1919, S. 5 (4)). So there will then be an opportunity for everyone concerned to offer his views upon one definite considered scheme, the outcome of the Commissioners' consideration of what they have heard in the preliminary inquiry, all other sources of information open to them, and their own expert judgment. Criticism and discussion of such a single concrete scheme will be much better directed and more fruitful than the somewhat confused encounter which has been going on for the last seven weeks, in which the promoters of every scheme have been opponents—more or less—of every other, and all have had to encounter objections from many other quarters. One advantage will be that there is a single scheme, not subject to alteration from day to day, until no one can say that he stands for any scheme as submitted,

and no one can be quite certain what the schemes under consideration are. Nothing has been more confusing than these sudden alterations, and one may suggest that the Commissioners will save time in future inquiries if they tighten up procedure in respect of alterations after schemes have been submitted. It is the fact that no scheme for London submitted to the Commissioners on March 31st is that they are now asked to consider. Even the "supplementary particulars" asked for by the Commissioners made material alterations in the schemes as submitted. The original "technical scheme" agreed on by three of the promoters has gone. The area to which it is to be applied, in two of these three cases at least, is not that of the delimited district, which these three promoters originally accepted. Most embarrassing of all—to the said promoters—the ostensible grounds for the alteration to the original technical scheme have vanished in view of the declarations of other parties. It may be suggested that the Commissioners already feel the necessity of making some rules of procedure for future use which will minimise such confusing changes.

For positive suggestions to save time and expense it seems as though the procedure might be made rather that of a Conference of promoters of and objectors to schemes, that each party, by counsel if desired, and by at least one witness, should explain its schemes and objections, that examination by the Commissioners should take the place of cross-examination (counsel having the right to suggest questions which the Commissioners might or might not put), and that the closing speeches of counsel or other representatives of the parties should be limited to specific points to be indicated by the Commissioners.

It may be recalled that the Commissioners have powers to require the attendance of witnesses and the production of documents, also to take evidence on oath, which powers they have not so far seen fit to exercise.

Some recognition in the rules of procedure and the conduct of the inquiries, that the Commissioners are neither a Court of Law nor a Parliamentary Committee, but an expert tribunal, would further tend to shorten the proceedings.

ELECTRIC ARC WELDING IN THE MANUFACTURE OF NEW BOILERS.

As will be well known to our readers, a great deal of work has been carried out in the repair of boilers by electric welding. During the last ten years its application has been gradually extended until now there is no doubt that whenever wasted parts have to be made good this method is preferable to any other, being more efficient, cheaper, and taking much less time than any other method of repair.

When the best methods are employed, and when the work is put in the hands of those who have specialised

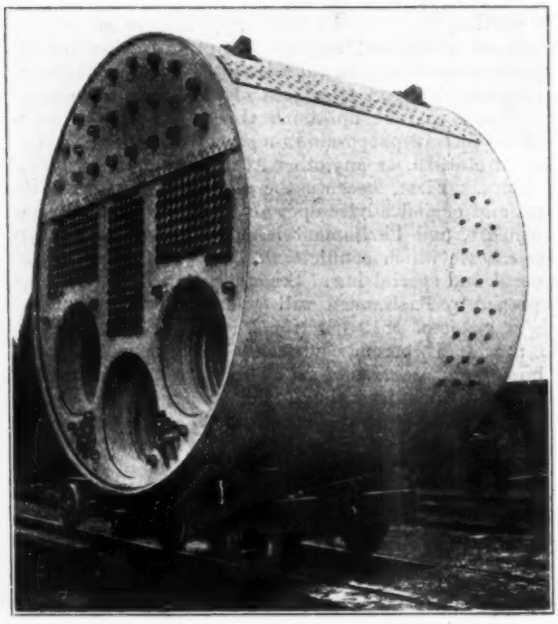


Fig. 1.—Hawthorn-Wyber Welded Boiler.

in it, excellent results are obtained and repairs can in many cases be made in such a manner that the boiler is as good as new. We have been informed of one case where new furnaces were ordered for a boiler in 1913, in case certain electric welding repairs should not be found reliable. Up to the end of 1920 there had been no necessity to fit the new furnaces.

In view of the success with repair work it was decided some 18 months ago by Messrs. R. & W. Hawthorn Leslie & Co., Newcastle-on-Tyne, to construct a new marine boiler with most of the joints welded in place of being riveted. This boiler is now known as the Hawthorn-Wyber welded boiler, and a photograph of the first of this type is reproduced in fig. 1. The boiler was specially designed, and the design has been protected by letters patent. From the details shown in fig. 2 the methods employed will be perfectly clear, and it will be seen that the construction is very much simplified by employing welded in place of riveted joints. It will be noted that the flanging of the end plates, a difficult and expensive operation, is altogether dispensed with, as is also the flanging for the combustion chamber joints. The saving in coal consumption alone in the plate-heating furnace for levelling and annealing the flanged end plates, is estimated at about 20 tons. In the size of boiler illustrated when riveted joints are used there are 290 rivet holes, 1.312 in. diameter, to be

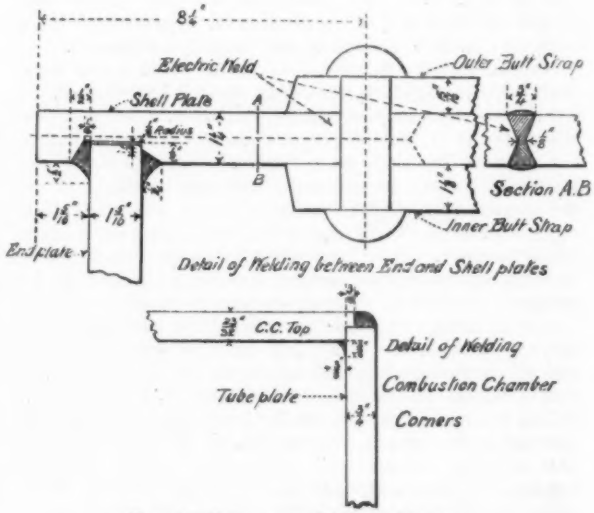


Fig. 2.—Details of Welded Joints.

drilled through the double ply of plate at each end of the boiler, and at the front end of the shell the holes have to be counter-sunk and the riveting done by hand. All this work is, of course, dispensed with in the welded boiler. The following are the main particulars of this boiler:—

15 ft. 6 in. internal diameter.
11 ft. 6 in. mean length.
Three corrugated furnaces, outside diameter 4 ft. 2½ in.
Working pressure, 180 lb. per sq. in.
Hydraulic test pressure, 360 lb. per sq. in.

Referring to the joint between the shell and the end plates, the width at the bottom of the groove in the shell plate is ½ in. wider than the thickness of the end plate with a ½-in. bevel at the top of the groove. This enables the welder to get a solid body of metal which is in compression. The welding inside the boiler is only intended to prevent water getting between the end plate and the shell plate and causing corrosion. These grooves are machined on a planing machine while the shell plate is in the flat, the shell plate being afterwards bent ready for the end plates. The end plates are turned 1/16 in. less in diameter than the bottom of the groove. It will be seen that the combustion chamber plates having pressure on the outside are recessed into one another and welded outside and inside.

A careful study of the methods of construction will clearly show the saving of time and labour possible in the manufacture of a welded boiler.

As regards the actual welding of the first of these boilers, preliminary trials were carried out in the first place, and after these trials it was decided to use the Kjellberg system as likely to give the most satisfactory results. The work was accordingly entrusted to the Anglo-Swedish Electric Welding Co., Ltd. There was in all a total length of about 500 feet of welding, and this was carried out so successfully that the boiler was absolutely tight the first time it was tested to 360 lb. per sq. in., *i.e.*, double the working pressure, without touching up of any kind being required either during the tests or after prolonged steaming. The boiler has now been under steam at Messrs. R. & W. Hawthorn Leslie's St. Peter's Works for about 12 months, and has never given the slightest trouble. It has further been approved by Lloyd's Register of Shipping, the British Corporation, and Bureau Veritas.

We are informed that Messrs. Hawthorn Leslie are prepared to grant licences for the use of the design covered by their patent.

CONDITIONS IN SPAIN.

In our issue of July 1st ("City Notes," p. 23) we made brief reference to the financial results of the operations of the Barcelona Traction, Light & Power Co. We return to the subject now because the directors' report, a copy of which has reached us (it was issued in Canada at the end of June), deals in fuller detail with the conditions which prevailed in Spain during the year ended December, 1920, and expressed the hope that the worst period has passed, and that slow recovery is probable.

The report shows that there was an increase of Pts. 6,128,683.25 in the gross earnings of the combined enterprises of the companies operating in Spain over those for the year 1919, and in the net earnings an increase of Pts. 5,044,321.95. These increases must be considered very satisfactory in view of the unfavourable political and labour conditions prevailing during the year, and are accounted for chiefly by the prices for energy, under many long-dated contracts, being raised by consent of the customers, and partly by the increase in the private lighting tariff which took place towards the end of the year, and also by the very large increase in the earnings from the operation of the Cataluña Railway.

The year under review was in many respects one of difficulty and anxiety. The conditions of unrest described in the previous annual report continued until February, 1920, necessarily involving heavy loss of revenue—the consumption of power in the areas served by the Ebro Co. falling as low as 58.5 per cent. of the normal demand. Drastic action by the local authorities in suppressing the syndicalist organisations led to a marked improvement, and business revived appreciably during the spring and summer, though sporadic unrest continued until November.

Apart from the temporary paralysis of local industrial activity, there was a great shortage of unskilled labour, due to emigration in search of the inflated wages being paid in France and the United States, so that all constructional operations were seriously interfered with, and such work as could not be postponed was necessarily carried out at an increased expense.

In December of 1920 the Bank of Barcelona suspended operations, with the result that industrial and commercial enterprises throughout the province of Cataluña were seriously affected.

The rate of exchange throughout 1920 was also an adverse factor, having risen from 19.57 pesetas to the £ in January to 23.92 in June, and 26.90 in December.

Notwithstanding the unfavourable conditions referred to, the City of Barcelona and the surrounding districts are full of vitality. In all directions building is in progress, and traffic increases in intensity. Given only a cessation from labour unrest and political agitation, with a relaxation in general economic conditions, development would move rapidly forward, involving greatly increased demands upon the services of light, power, and transit.

With the completion of the new hydro-electric installation at Camarasa, ranking amongst the most important in Europe, the major construction projects of the Ebro Co. may be regarded as realised. Two sets of 17,500 h.p. each are in operation, and by the addition to this plant, as and when required, of three further sets the company will have electrical power available to meet all demands for some years. Considerable extensions have been made to the distribution system during the year, but as the demand for power grows the system will have to be greatly extended.

The result of the year's operation of the Cataluña Railway Co. (Ferrocarriles de Cataluña) was highly satisfactory. The popularity of its services is undoubted. Work upon the extension to Sabadell, commenced in November, 1920, is now well advanced, and there is every indication that the volume of traffic on this branch will equal that already attained on the Tarrasa section.

For the purpose of financing this extension, a contract was made for the sale of Pts. 10,000,000 of the 5 per cent. 50-year mortgage bonds of the Ferrocarriles de Cataluña, of which Pts. 5,750,000 had at June 1st, 1921, been taken up and paid for in accordance with the terms of the contract.

The operating results of the Tramway Co. (Les Tramways de Barcelone) showed an increase in gross earnings of nearly 25 per cent. over those of the previous year, but, owing to a large increase in operating costs, the increase in net earnings was only about 14 per cent.

Towards the end of 1920 the sharp fall in wholesale values of raw materials, and especially cotton and wool, had the same paralysing effect upon industry in Barcelona as in other parts of the world, and this was intensified by the financial stringency caused by the failure of the Bank of Barcelona already referred to. As a result, since the beginning of 1921 numerous textile mills have closed and many others are working on short time. This has had its effect on the operating companies, directly, through the reduction in the amount of power consumed, and, indirectly, in other ways. It is hoped that the worst period has been passed, but it is probable that the recovery will come slowly.

ELECTRICITY SUPPLY ADMINISTRATION.

A report has been published by the Minister of Transport respecting the applications to, and proceedings of, the Ministry under the Electricity (Supply) Acts, from June 27th, 1920, to March 31st, 1921. (15s. Price 1d. net.)

It states that the estimated net expenditure of the Electricity Commissioners for the period from the date of their appointment to March 31st, 1921, was £43,500. The fund out of which the expenses of the Commissioners are defrayed will be provided by contributions levied upon the electricity supply industry, although temporarily financed by advances from the Exchequer for the first two years. The repayment of the advances, together with interest, will fall to commence in the financial year beginning April 1st, 1922.

The Electricity Commissioners have submitted to the Minister for confirmation Special Orders made by them relating to the Urban District of Panteg and the Rural District of St. Mellons (South Wales Electrical Power Distribution Co.), and the Urban District of Mynyddislwyn (Urban District Council).

The Minister made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, in some 90 cases, and under Section 32 of the Schedule to the Electric Lighting (Clauses) Act, 1899, or corresponding provisions, in 69 cases (two of which come under both heads).

The Minister made Orders extending the time for carrying out the compulsory electricity works scheduled to the Orders or Acts for Bradford-on-Avon, Lurgan, Portrush, Rickmansworth and Chorley Wood, Yeovil, Crowborough, Ormskirk, Sidmouth, Sidmouth (U.D.C.), Skegness, and Yorktown and Blackwater.

The Minister gave consent to the erection of overhead lines by the undertakers under 29 Acts and Orders, and under Section 22 of the Electricity (Supply) Act, 1919, to an application by the undertakers under the Woking Electric Lighting Orders for a wayleave for part of the route of an overhead line.

Under Section 18 of the Electricity (Supply) Act, 1919, four applications were made to the Minister for the construction by him of generating stations or main transmission lines pending the establishment of joint electricity authorities in certain districts provisionally determined by the Electricity Commissioners. After consultation with the Commissioners

one of the applications was not entertained. In two cases, however, the Minister decided to proceed with the construction of the works subject to certain conditions. In one of these cases the application was subsequently withdrawn, and in the other the interested parties were unable to give the required guarantees, and the application therefore lapsed. The fourth application is under consideration.

In addition to advising the Minister in the exercise of his powers and duties under the Electricity (Supply) Acts, 1882 to 1919, the Electricity Commissioners also exercise certain statutory powers and duties vested in them by the Electricity (Supply) Act, 1919, and certain other powers and duties delegated to them by the Minister. With the concurrence of the Minister the Commissioners have prepared, for separate publication, a report dealing fully with their proceedings for the information of the electricity supply industry and the public generally. The report covers the period from the appointment of the Commissioners (January, 1920) to March 31st, 1921, and relates to the following matters:—

Under the provisions of Section 5 of the Electricity (Supply) Act, 1919, the Commissioners provisionally determined 13 electricity districts. Local inquiries were held by the Commissioners in respect of three of the districts, namely, the Lower Severn, the Mersey and West Lancashire, and the North Wales and Chester Electricity Districts. The first-named inquiry was adjourned and has not yet been resumed, but the other two inquiries were carried to completion.

Subsequent to the date to which the report is made, the Commissioners issued their decisions in respect of the two districts and the schemes submitted in connection therewith. Draft Orders embodying the decisions are in course of preparation by the Commissioners.

The Commissioners issued their formal consent in the case of eight applications relating to the establishment of new generating stations, in the case of four applications relating to the establishment of main transmission lines, and in upwards of 120 cases relating to the extension of existing generating stations. The new generating stations sanctioned represent the initial installation of approximately 150,000 kW of generating plant, with the possibility of further extensions at a later stage. The authorised extensions of existing stations represent approximately 550,000 kW of generating plant.

Over 500 applications were received by the Commissioners for sanction to the borrowing of money by local authorities for the purposes of their electricity supply undertakings. Sanction to borrowing was granted in the case of 432 applications, the total amount of the loans sanctioned being £15,181,298, which included (*inter alia*) £9,805,990 in respect of plant, and £3,428,161 in respect of mains and services. The Commissioners in every case satisfied themselves that the proposed expenditure was necessary for enabling the undertakers to carry out their statutory obligations and that the cost of the proposed works was reasonable.

The Commissioners made Statutory Rules with regard to applications for Special Orders under Section 26 of the Act of 1919 on August 10th, 1920, which were laid before Parliament as required. The Commissioners received 28 applications for Special Orders, and four applications for Provisional Orders lodged with the Board of Trade prior to the appointment of the Commissioners were subsequently transferred to the Commissioners by the Board. Of the 32 applications under consideration, the Commissioners refused two, and made Special Orders in respect of three. The remaining applications were under consideration at the date to which this report is made (five further Special Orders have since been made).

The Commissioners approved in ten cases of agreements being entered into between authorised undertakers for mutual assistance or for the taking of bulk supplies, and made 71 Fringe Orders permitting various authorised undertakers to supply electricity to specific premises situated outside their authorised areas of supply. They approved the adoption of special systems of supply in the cases of 15 undertakings.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Gescha" Cable Connector.

The new invention illustrated in fig. 1, the importers of which are Messrs. R. May & Co., of 27, Oliver Grove, S.E. 25, permits reliable contacts to be made in cable thimbles, connection sockets, T-pieces, and branch terminals, without the use of screws and soldering tin.

The novelty of this, which is a German invention (British provisional patent No. 35,734 for sale), is centred in the reciprocal conical tension which results, after the introduction of the cable, from driving the semi-cylindrical, conical-shaped extension of one part into the corresponding recess of the

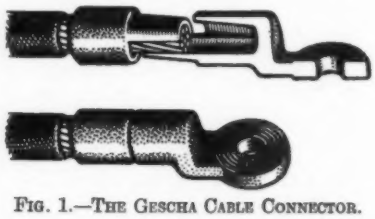


Fig. 1.—The Gescha Cable Connector.

other part. The contact surface is perfectly cylindrical and drilled to template and therefore absolutely metallic. The pressure is so strong that the outer wires of the cable are flattened. All loosening is impossible even under constant vibration, because the angle of inclination (5 deg.) is far below the frictional angle (13 deg.). The work of installation will only occupy a few seconds. It is also of great advantage that complete independence is obtained from the skill and attention of the workman, as the position of the terminal when once fitted must always be such as calculated for the cable in question.

Service Cut-outs for Housing Schemes.

There are many ways of cutting down the cost of house services—always an important item in the cost of distribution—and especially so nowadays with high-priced material and labour. A method now finding an increasing number of adherents is that of grouping together blocks of two, three, or four houses, and serving each block by one service cable only, thus cutting down the length of cable and the number of joint boxes required. This method necessitates the use of a special service cut-out, and to meet the increasing demand for this economical arrangement, Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, London Wall, E.C., have placed upon the market a new range of cut-outs for groups of houses.

We reproduce a drawing (fig. 2) of the four-way d.p. cut-out with four bridge type fuses and a four-way neutral connector. The fuse units are connected by a special adjustable busbar fitting which ensures correct alignment of the contacts and simplifies connecting up the service cable. A service to each house is taken off each pole through the top of the

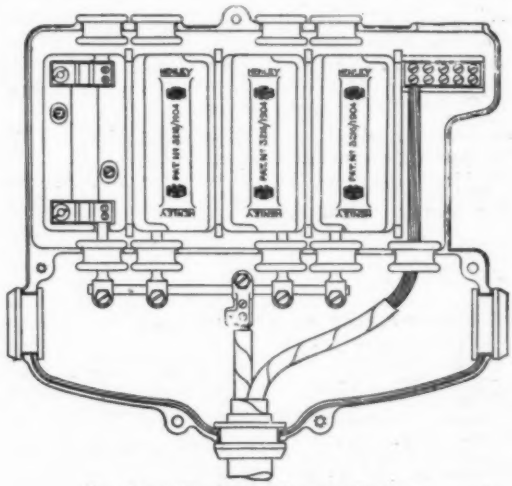


Fig. 2.—A Four-way Service Cut-out

cut-out in the usual way. The range covers circuits up to 50 amps., 250 volts, two, three, or four-way. Where required armour grips can be fitted for the incoming cable.

These cut-outs are also specially suitable for blocks of flats as the service cable can be brought up to the block and individual services taken off to each flat.

A Smoke Detector.

A mechanical device which automatically records the presence of smoke in the surrounding air was recently demonstrated at The Studio, 5, Great Newport Street, W.C. 2. It is claimed to be an advance on the principle of the existing fire detectors, as it does not wait for the outburst of flame, but gives the alarm with the appearance of smoke merely.

The instrument is extremely sensitive, but its sensitiveness can be adjusted to any degree.

The detector is open top and bottom to allow of free circulation of the atmosphere through the instrument. It is fitted internally with a pair of very sensitive expansion chambers, which act in unison under normal conditions. These expansion chambers are somewhat similar in action to the vacuum chamber of an aneroid barometer, and are geared in such a manner that when they move in unison they keep the electric circuit open and no signal is given. If smoke enters the instrument it will destroy the balance of the two expansion chambers, thereby completing the circuit through a relay, which can actuate any warning signals or fire extinguishing apparatus desired. In cases where heat detectors are at present installed, the addition of a smoke detector, which can readily be looped into the circuit, will greatly enhance the protection from fire.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Oil Consumption and Prices.

Re the note in your issue of July 29th by Mr. E. F. Butler, the 1,000-kW set he quotes has certainly set up a record, and seeing that the notes in your and other engineering papers are often taken as correct, I should be very grateful if Mr. Butler would confirm the figure of 350 gallons, which equals 0.00004 gallon per kWh generated.

Below I give several sets of figures for various stations using large turbines, Diesel engines, and gas engines, which have been under my charge, the figures being taken from actual costs sheets:—

Type of station.	Capacity kW.	Units generated per week.	Oil consumption per kWh generated.
Turbines	48,000	3,179,792	0.00005
Turbines and engines	3,500	33,610	0.0003
Diesel	300	15,074	0.0009
Gas engines ...	8,000	500,000	0.00009
Mr. Butler's quotation—			
Turbine	1,000	164,640	0.00004

It will be noted from the above that the 1,000-kW set is able to show a lower oil consumption than the 48,000-kW station, and it would be very interesting to hear from Mr. Butler how this is carried out.

I have done a lot of work in connection with oil filtration and the lowering of costs, so much so that I have obtained the Diesel figure given above, and with a 1,000-kW Diesel a figure much lower would be obtained, which would be in the neighbourhood of 0.00008 gallons per kWh generated, and would be a very close competitor of the large turbine.

It will be seen from the above figures that a great deal of difference does not occur in the oil consumptions of internal combustion engines *versus* turbines.

Dealing with the fuel used and costs per kW generated of turbines *versus* Diesel engines, a very useful article will be found in this month's issue of *Gas and Oil Power*.

I shall be glad to receive Mr. Butler's remarks on this matter, as I assume his informant must have a very efficient method of filtering and reclaiming the oil used.

S. H. Fowles, A.M.I.E.E., A.M.I.Mech.E.

Jarrow-on-Tyne.
August 1st, 1921.

Testing and Repairing Magnetos.

"Repairer's" letter in your last issue gives (just as he states) the usual method of testing for a complete breakdown of primary, secondary, or condenser, but it will not determine a partial breakdown, which, although it may not be serious enough to cause an appreciable diminution of spark length at the moment, yet will eventually develop into a complete breakdown. Such faults are: Earth in bottom layer of primary; short between two or three layers of secondary; condenser short which has burned itself clear, but started charring of insulation, which will cause further trouble. I cannot agree with "Repairer" that a broken-down slip-ring will always be indicated by a smell of burning ebonite (though such is usually the case); it would be a serious mistake to condemn the secondary and strip and rewind it because there was no smell of burnt ebonite when testing. This method of testing with an interrupted current is quite common in repair shops (although the idea of using the magnetism in the magneto core to actuate the break is new to me).

With regard to removing ball-races, the various devices made like miniature pinion-pullers are all failures when they come to a really tight ball-race; they either slip out of the groove, bend, or break.

To come to the matter of practical repairing, it would be interesting to have the opinions of "Repairer" and others on winding machines; there are two great classes of these, namely, purchased and "home-made." Of the former there are only two or three makes, but the "home-made" types are legion, and in my experience usually far more satisfactory than the bought machines. The commonest fault is wire breaking; next comes overshooting margin at ends of layers; not stepping quickly enough (in case of hand-stopped machines); or stopping too early or too late (in case of automatically-stopped machines). The most successful magneto-repairer I know is a man in a very small way of business, who does all his winding with a small lathe, with a crank handle fixed to the headstock spindle and the wire guided on by hand; this method may seem very crude, and it is certainly very tedious and comparatively slow, but by practice he has attained marvellous speed, and such things as breaks, over-running, &c., are unknown. Another matter on which considerable diversity of opinion exists is that of testing the strength of magnets. The two usual methods are: spring-balance and keeper; and distance which magnet will lift a small iron bar. Both of these methods should be all right if there were standard weights which each magnet should pull, or standard distances through which a bar of certain dimensions and weight should be lifted, but when one shop passes as O.K. a magnet which pulls 5 lb. before parting, while another must get a 10-lb. pull from the same size magnet, it is fairly obvious that clear knowledge and standardisation is badly needed.

Mag.

August 7th, 1921.

Re "Mag's" letter, surely there are many ex-Service electricians who were engaged during the war on the upkeep of magneto and various ignition systems, and could effect improvements on these firms' methods.

J. H. Owen.

Ruabon.
July 30th, 1921.

Leeds Electrical Training Centre.

I have pleasure in supplying the following further information on the subject which is referred to in the letter from your correspondent "Rotary."

The transformer was one of a variety of special orders which are accepted in our electrical department in order to give trainees practice in actual construction, after they have acquired sufficient knowledge and skill by carrying out the graduated exercises which occupy the earlier part of the course of training. Such exercises are necessary in order to provide a general all-round training in the time available, but they need to be supplemented by a certain amount of complete construction to maintain the learner's interest, and to give him confidence in his work.

The 20,000-volt transformer was one of these orders, and in this sense only was it special. The whole of the work was done by the trainees themselves, the skilled instructor merely directing and supervising their work. It should be understood that the necessary skill in manipulation had been gained by the repetition of similar steps in the course of exercises. In this preliminary training each process has to be repeated by the learner until he can execute it to the satisfaction of the instructor. It is only then that he is allowed to proceed to the next step in the course.

The result of this systematic instruction is that a complete job can be undertaken with a reasonable prospect of success on the first test, as in the present instance. It was not until the pressure reached 100,000 volts that discharge took place across the terminals of a coil. The pressure was again run up and reached over 100,000 volts before a breakdown occurred, this time at a coil terminal. When it is borne in mind that the tests were made on the unfinished transformer, and in air instead of in oil, as is intended, it will be agreed that the work was a credit to the trainees and a proof of the thoroughness of the instruction.

This department of the school is run as nearly on business lines as is consistent with the exigencies of training. If "Rotary" or any other of your readers would like to see the methods of instruction for themselves, they might call here, and Mr. H. J. Fuller, who is in charge of the electrical training workshops, will be pleased to show them over the same any day (except Saturdays) after the 15th inst.

R. E. Barnett,
Principal.

Central Technical School,
Leeds.
August 3rd, 1921.

Battery Explosions.

The lack of detail in "Denze's" letter in your last issue makes it a little difficult to visualise the exact conditions under which the explosions occurred.

It is to be presumed that the storage cells in question are of the small portable type, having lids which enclose the tops, and as the charging of the three cells was almost complete, it is quite likely a quantity of hydrogen and oxygen gases had accumulated in the top of the cells, thus forming an explosive mixture, which, if ignited, would explode with a loud report.

In connecting the fourth cell in series with the other three, it is possible that at the point of interconnection a spark occurred, and as the atmosphere in the neighbourhood of the terminal of cell No. 3 might very easily be charged with the explosive mixture of gases extending from the cell vent, this would account for the explosion occurring. I have known

similar instances to occur on many occasions, and as there is a tendency on the part of some battery users to-day to prefer an "enclosed" type of cell, even in a medium size, as used for house lighting and stationary purposes where portability does not necessarily enter into the question, it is perhaps advisable to sound a note of warning and remind such users that wherever there is any chance of battery gases accumulating, whether in the cell itself or in a larger space, such as a battery room, the utmost care should be taken to avoid a light or spark being brought into the vicinity where the gases are.

It is true that with an "enclosed" type of cell, an explosion of the kind reported by your correspondent usually results in the cell suffering some damage, but as no mention is made of any such damage in this instance, it points to the possibility of the cells not being of the "enclosed" type. If such is the case, and the cells have their tops open to the air, it is still possible that the surrounding atmosphere contained sufficient battery gases to form an explosive mixture, and even a small spark would suffice to cause the necessary ignition.

With cells contained in celluloid boxes, the danger is still worse. The white froth which appears in some types of celluloid cells during charging is highly explosive, and I am not sure whether your correspondent may not be referring to such froth when he refers to the "milky-white" appearance of the electrolyte.

I am also not clear what is meant by the electrolyte being "greatly disturbed," but possibly the concussion caused by the explosion was sufficient to liberate some of the occluded gas from the plates, and the passage of the gas bubbles through the electrolyte might have given the latter the appearance which your correspondent describes as "greatly disturbed."

F. J. Holmes,
Hart Accumulator Co., Ltd.

London.
August 8th, 1921.

With reference to the above matter, the explanation is as follows: During charging the water in the electrolyte is decomposed and split up into its constituents H^2O, *i.e.*, two parts of hydrogen and one part of oxygen—a most explosive mixture, and easily ignited by a defective contact or the fusing of connecting wires on the charging cells. Some people are careless enough to use 5-amp. fuse wire to connect one cell to another, and the result is, in many cases, that the wire fuses, and coming in contact with the celluloid casing, sets fire to it, as well as causing an explosion that wrecks the whole cell.

A friend of mine was nearly blinded some years ago by a similar experience, the electrolyte being shot into his eye when bending over and disconnecting some charged cells.

Should any of your readers have the misfortune to experience such a painful accident, the remedy is immediately to dash the face in a bowl of clean water and open the eyes wide whilst under water.

J. Thain.

Gloucester.
August 6th, 1921.

[Dilute ammonia should always be kept handy where acids are used.—Eds. Elec. Rev.]

THE FARADAY SOCIETY.

Piezo-electric Effects in Rochelle Salt Crystals.

The feature of the June meeting of the Faraday Society was a demonstration by Mr. E. Kilburn Scott of the remarkable piezo-electric properties of Rochelle salt crystals. The experiments were originally carried out on behalf of the American Telegraph & Telephone Co., by Mr. A. McLean Nicolson, and they promise important applications in telephone practice. The effect is based on the well-known fact that many crystals will become electrically polarised when subject to changes of stress and conversely they will dilate or vibrate when electric forces are applied to them. The effect takes place in crystals which are optically active because of their asymmetrical structure, and it has been found particularly in Rochelle salt crystals (sodium potassium tartrate) prepared in a certain way described in detail in the paper, which, on account of the rapidity of growth, develops internal stresses in the crystals.

The finished crystal after drying, baking, and other suitable treatment, is varnished and waxed tinfoil electrodes are pressed on it. It is then placed between two aluminium disks held together by small steel springs, which can be tightened by thumb screws after the crystal has been inserted. Any part of the metal structure will readily convey vibrations to the crystal, which in turn may be converted into telephonic currents. A crystal used on a phonograph record, and adjusted so as to be subject to torsional vibrations, will generate several volts, and can operate a large number of telephone receivers—as many as 200 receivers have been operated from one crystal.

With the aid of a vacuum tube amplifier very good transmission of speech and music may be obtained by using these crystals at both ends of a long line as the sole transmitting and receiving apparatus.

High Temperature Phenomena of Tungsten Filaments.

At the same meeting, Mr. C. J. Smithells, on behalf of the research staff of the General Electric Co., gave an account of recent experiments on the above subject.

It is well known that nitrogen or argon at about one atmosphere pressure is now introduced into tungsten-filament lamps in order to suppress volatilisation of the filament and permit of a higher temperature being employed, and hence higher efficiency. This higher temperature has introduced new problems in the behaviour of the filament, and the experiments described were carried out in order to study causes of failures in filaments due to:—

1. Alteration in the crystalline structure giving rise to brittleness and deformation.

2. Reactions between the filament and gases existing in the lamp.

(1) In gasfilled lamps the filament reaches a temperature of 2,500 deg. K., and considerable changes take place in the structure of the filament. Two types have to be considered, the pure tungsten filament and one containing up to about 1 per cent. of a refractory oxide, usually thoria. The pure filament before burning has a fibrous structure, but on incandescence the fibres break up into crystals. In a gasfilled lamp the crystal growth takes place very rapidly, and continues until the diameter of the crystals is about equal to that of the wire. Mr. Smithells showed some striking lantern slides illustrating these changes, and it was interesting to note that a filament burning 600 hours was not substantially different from one which had burnt some 20 hours. The increase in grain size brings about deformation in the filament, and hence lessens its mechanical strength.

In the so-called "thoriated" filaments crystal growth is restrained, and the filament is composed of relatively small grains even after 600 hours' burning. Hence these filaments deform very little.

In some cases red phosphorus and other reducing agents are introduced to remove traces of oxidising gases, and the effect of these on the crystal growth has also been studied. It was found that the grain size obtained with a thoriated filament and excess of phosphorus had the same value as that obtained with pure tungsten.

(2) The second part of the paper dealt with chemical reactions which occur in gasfilled lamps when traces of impurities are in the gas. In the case of hydrogen there is no reaction. A small quantity of oxygen rapidly attacks the filament, and is probably the cause of the frequent blackening of bulbs. The presence of water vapour has the effect of thinning the filament at points adjacent to the supporting wires and the filament ultimately fails. This action is due to formation of tungsten oxide at the hotter points of the filament and subsequent reduction at the colder points.

The action of carbon dioxide is similar to that of oxygen. In the case of carbon monoxide this gas is broken down to carbon, which is deposited, and carbon dioxide which slowly attacks the filament. Hydrocarbons attack the filament very vigorously, and it becomes brittle and soon breaks.

The following papers were also presented: "The potential of the iodine electrode, and the activity of the iodine ion at 25 deg. C.," by A. McKeown; "The influence of the solvent upon ionisation and the accompanying heat effect," by Sidney Maurice Neale; "A simple apparatus for determining the coagulation velocity of gold sols," by Emil Hatschek.

The Demand in China.—According to a statement said to be based upon the report for 1920 of the Chinese Marine Customs Administration, the demand for electrical plant is greater than the supply. Towns of a population of 30,000 persons in South China were equipped with installations years ago, and this development has constantly increased.

Cleaning Condensers.—The use of hydrochloric acid for cleaning condensers was described by Mr. N. G. Hardy in the *Electrical World* of July 9th. The tubes are first washed out with water and the scale is removed from the water boxes; after cleaning and thoroughly drying, the water boxes, heads, and tube sheets are painted with two coats of roofing cement, and the water inlet and outlet are blanked off. After replacing the heads, the water box is connected to a steel tank at a higher elevation, vent pipes about 12 ft. long are connected to the water compartments, and a brass centrifugal pump to circulate the solution is coupled up to the water box. Commercial acid containing about 24 per cent. H Cl is used, 1,000 lb. of acid being mixed with 7,800 lb. of water, which gives a strength of about 3 per cent. The pump is run for four or five hours, when the acid is entirely neutralised. The solution is allowed to stand for a day; it is then drained out, and the tubes are individually washed and brushed with a wire brush. The great advantage of acid treatment is that the scale is softened and loosened, so that it can be easily removed. It is better to treat a very dirty condenser several times with weak acid than to use a stronger solution. The cost of the acid is an objection to the method where the tubes are in good condition and the scale is not too hard for mechanical cleaning; but no serious damage is done to the tubes by the use of acid, and the loss due to breakage of old tubes in the course of mechanical cleaning is avoided.

BUSINESS NOTES.

Company Liquidations.—Wholesale Electrical Co., Ltd., Oxford Street, London, W., and Dunsmure Road, Stoke Newington, London, N.—The statutory meeting of the creditors of the above was held on August 5th at the Institute of Chartered Accountants, Moorgate Street, E.C. Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., one of the liquidators of the company, presided. The statement of affairs presented showed liabilities of £10,602, of which £9,676 was due to the trade, while the bank was interested for £219, and there were sundry creditors for £307. A sum of £400 was set down as owing in respect of E.P.D., but it was pointed out that owing to the losses latterly made by the company that claim would probably be withdrawn, while it might also be possible to obtain the repayment of a similar sum. The assets were estimated to realise £7,600, from which had to be deducted £883 for preferential claims, leaving net assets of £6,717. The assets were as follows: Book debts £1,692, estimated to realise £1,500. Stock-in-trade £9,142, expected to produce £5,000; fixtures and fittings £577, valued at £100; machinery and plant at Dunsmure Road £2,447, expected to produce £1,000. About 50 per cent. of the stock represented partly made goods, and at a forced realisation would not realise anything like their value. The liquidators were of the opinion that it would be best to finish the manufacture of the stock, and there would be no difficulty in disposing of it. The leasehold factory at Dunsmure Road was held on a long lease at £800 per annum. The company, in June of last year, paid a premium of £1,500 for the lease, but its present value was doubtful. Mr. Hawkins reported that the company was registered in July, 1915, with a nominal capital of £2,000. The capital was increased to £10,000 in January of last year. The company was formed and acquired an existing business, and allotted to the vendor 835 fully-paid shares of £1 each for the goodwill of the business. The company carried on business successfully up to last year. During the year ended June 1917, the turnover was £25,600, with a gross profit of £2,600 and a net profit of £357. In the following 12 months the turnover increased to £41,938, the gross profit being £3,790 with a net profit of £640. During the year ended June, 1920, the turnover rose to £71,475, with a gross profit of £14,607 and a net profit of £1,262. In the following 12 months the sales dropped to £34,400, the gross profit being £7,230, and there was a net loss on the trading of £3,960. The present position of the company was attributed to the general depression in trade, strikes and the delay in receiving deliveries from manufacturers. In answer to questions, Mr. Hawkins stated that there were no debentures or any charges on the assets. The matter was a straightforward one, and there was practically nothing to call for comment. A resolution was unanimously passed confirming the appointment of Mr. E. H. Hawkins and Mr. T. W. Greaves as the joint liquidators of the company, while an informal committee of the principal creditors was also elected. The following are creditors:—

	£		£
Allam, E. P.	15	Johnston, R., & Co.	12
Armstrong, Stevens & Co.	27	Kent, W.	219
Adams, George	45	Lilley & Son	237
Accessories Electrical Co.	66	Lofthouse, Crosbie & Co.	239
Burrows & Dunns	62	Leach, S. G., & Co., Ltd.	28
Buck & Hickman	20	Lowe, M. H.	13
Bonnella Bros.	237	L.W.C. Electric Construction Co.	49
Bullers, Ltd.	1,256	Lawton & Son	108
Bray, G., & Co., Ltd.	26	Manifoldia, Ltd.	18
Cranfield Rubber Co.	270	Metal Tubes & Fittings Co., Ltd.	28
Campart, C.	200	Makin, W., & Co.	18
Cheadle & Waltho, Ltd.	158	Malleable Fittings Co.	17
Cakebread, C.	11	Marbro, Ltd.	15
Chapman, H. W., Ltd.	30	McKechnie Bros., Ltd.	31
Chubb, J.	10	Norris, T. G.	127
Corke, C. E., & Co.	15	Newman Electric Co.	16
Dale Forty & Co., Ltd.	137	Partridge, H. A.	10
Dellagana, B., & Co., Ltd.	11	Scupham & Wood	41
Diamond Co., Ltd.	13	Reliance Electric Wire Co., Ltd.	18
Durand, Sedgwick & Bird	31	Seage, A., & Co.	15
Dorman & Smith, Ltd.	10	Sells, Ltd.	121
"Electrical Review"	50	Sydenham & McOustra, Ltd.	319
Electric & Ordnance Accessories Co., Ltd	67	Sweeney & Blocksidge	27
"Electrical Contractor" Co., Ltd.	49	Stone, H.	176
Foster Engineering Co., Ltd.	47	Stott, James, & Co.	17
Farmer & Co.	22	Shaw's Glazed Brick Co., Ltd.	11
Forester & Fox, Ltd.	28	Shenton, J., & Co., Ltd.	22
Gilson, D., & Co., Ltd.	396	General Accessories Co.	514
Geipel, W., & Co.	10	Tedische, V., Ing. & Co., Ltd.	463
Hawkins Bros. & Co., Ltd.	59	Wood Wool Fibre Co.	10
Griffiths Bros. & Co., Ltd.	15	Ward & Goldstone, Ltd.	54
Heaton & Dugard	474	Singleton, Benda & Co.	170
Harper, Sons & Co.	141	Taylor, Tunnicliffe & Co.	80
Hervé, L.	193	Watshams	10
Henry, A.	29	Wilson, John, Ltd.	25
Hand, C., & Co.	25	"Z" Electric Lamp & Supplies Co., Ltd.	14
Imperial Lighting Co.	13	Moir, Matthes & Co.	567
Ironclad Switchgear Mfg. Co.	15	Davis Gas Stove Co.	17

Gratze, Ltd., Whitfield Street, London, W., mechanical and electrical engineers.—The statutory meeting of creditors was held on August 4th at the Institute of Chartered Accountants, Moorgate Street, E.C. Mr. R. B. Gray, C.A., of 44, Gresham Street, E.C., the receiver for the debenture holders and the liquidator in the voluntary liquidation of the company, presided. He stated that the present company was registered last year and was formed to take over as from March 31st, 1920, the assets and liabilities of the old company, which traded under a similar name. The purchase consideration payable to Mr. Gratze, the liquidator of the old company, was £25,000, which was to be discharged by the allotment of £20,000 in shares and £5,000 in cash. The assets taken over by the company were valued at £33,615, but there were liabilities of £8,615 which had to be discharged. The assets taken over consisted of stock and work in progress, £7,291; plant, machinery, furniture, &c., £18,117; book debts, £2,297; leasehold premises, £2,500; and goodwill and patents, £3,409. The 20,000 fully-paid £1 shares were duly allotted to Mr. Gratze, but he only received £3,500 in cash, of which £700 came back to the company. Under those circumstances Mr. Gratze as the liquidator of the old company was now a creditor for £2,200. To provide funds for the new company £10,000 was obtained on debentures, while in April of the present year a further £2,000 was raised on debentures. The company took over a number of contracts, but finally the trade depression set in, and orders were cancelled, while no fresh inquiries came along. The unsecured liabilities of the company, the chairman stated, amounted to £8,419, made up as follows: Trade creditors, £2,609; directors' fees, &c., £1,471; cash creditors, £1,700; bank overdraft, £151; and liquidator of old company £2,486. The assets were set down at £26,536, but they were only estimated to realise £8,663, from which had to be deducted £538 for preferential claims, leaving net assets of £8,125. Those assets were not sufficient to discharge the claims of the debenture holders, and there was nothing available for the creditors. The deficiency as regardeu the creditors was £12,308, and as regarded the shareholders it amounted to £32,310. In answer to a question, the liquidator said he did not think there was any chance of the unsecured creditors ever receiving a dividend. No resolutions were passed and, therefore, the voluntary liquidation of the company will be continued with Mr. Gray as the liquidator.

Orizaba Tramways Syndicate, Ltd.—Meeting called for September 12th at Sardinia House, Sardinia Street, W.C., to hear an account of the winding-up from the liquidator, Mr. A. F. Dickin.

Sutton-in-Ashfield Motor & Electrical Engineering Co., Ltd.—Meeting of creditors called for August 16th, at 3, King John's Chambers, Brindlesmith's Gate, Nottingham. Liquidator, Mr. J. Keetley.

Bankruptcy Proceedings.—Harry Michael Wollman, 9, Greasboro' Road, Parkgate, near Rotherham, Yorkshire, electrical factor.—The public examination of this debtor was held recently at the County Court Hall, Bank Street, Sheffield. The statement of affairs showed liabilities amounting to £184, against assets £34. Debtor attributed his failure to trade depression, the coal strike, and losses through damage to goods. The examination was closed. The following are creditors herein:—

Marsh Bros. (Electricians), Ltd., £100; Phœnix Supply Co., Ltd., £79.

Edward Stanley Taylor, electrical engineer, Wilson's Buildings, Stenhousemuir, Stirlingshire.—At Falkirk, on the 8th inst., this examination in bankruptcy took place, after which the statutory oath was administered. Bankrupt stated that he started business in January, 1920, without any capital; he borrowed £60 in June of the same year. His statement of affairs showed that he was owing trade accounts to the extent of £834, and that between his stock and book debts his assets amounted to between £80 and £90. He calculated that he had lost £430 in under-estimating contracts, and that his expenses were generally bigger than his income. When asked if he attributed his bankruptcy entirely to losing on the various contracts, he said that he became insolvent in the first place through under-estimating; in the second place, owing to his high expenses in running the business, and, lastly, his position was due to what he described as victimisation by other contractors.

Robert Chas. Jones, electrical engineer, lately trading as Elect. Ma. Engineering Co., 10, Caledonia Street, King's Cross, N.—This debtor again attended before Mr. Registrar Mellor at the London Bankruptcy Court on Tuesday in relation to his public examination. Particulars of the failure recently appeared in these columns. Mr. F. T. Garton, Official Receiver, reported that the debtor had furnished the further particulars required, and he accordingly had no more questions to ask him. The examination was concluded.

Dissolution of Partnership.—Hallenan & Fletcher, taxi-cab proprietors, electrical engineers, &c., Halfway Garage, Cathedral Road, Cardiff.—Mr. E. P. Hallenan and Mr. T. J. Fletcher have dissolved partnership.

Trade Announcements.—The Jackson Electric Stove Co., Ltd., has appointed Messrs. Witty & Wyatt (Cardiff), Ltd., of 5, Burt Street, Clarence Road, Docks, Cardiff, as its agents for Wales and the West of England, and Mr. Blogg is not now its agent. The firm will hold a showroom stock.

The British Central Electrical Co., Ltd., has recently been appointed sole selling agent for Messrs. Richardsons, Westgarth & Co., Ltd., for the sale of their productions, comprising steam turbines, condensers, boilers, &c.

The publicity organisation of the General Electric Co., Ltd., has now been removed from Queen Victoria Street,

E.C., to the new head offices at Magnet House, Kingsway, London, W.C. 2 (telephone No.: Regent 7050, 50 lines), and all correspondence relating to publicity matters should be sent there.

The Magneta Time Co., Ltd., of Westminster, has acquired the control of the Standard Time Co., Ltd., 19-21, Queen Victoria Street, E.C., and "Magneta" directors have personally acquired the control of the Lowne Electric Clock & Appliances Co., Ltd., 108, Bromley Road, Catford, S.E., and the Silent Electric Clock Co., Ltd., 192, Goswell Road, E.C. 1. We are informed that the change is expected to result in reduced cost of manufacture. The Catford works are being considerably enlarged and additional plant is being installed. It is not intended to change the personnel of the various businesses, which will be conducted as heretofore.

The Wholesale Fittings Co., Ltd., has removed its Manchester branch to larger premises at 78 and 80, High Street, the first floor of which is fitted out as a showroom.

Messrs. Simpson, Baker & Co., electrical and mechanical engineers and merchants, have removed their Cardiff depôt to 12, Westgate Street, Cardiff. Telephone No. 3403.

Semaphore dry batteries and cells are now controlled by Messrs. Harwell, Ltd., of 2, Bayley Street, Tottenham Court Road, W.C.1, who are also sole selling agents for insulating material made by the Improved Solidite Co., Ltd.

Messrs. Twiss Electric Transmission, Ltd., of 39, Victoria Street, S.W.1, have added an extra telephone line, and the number has been changed to "Vic. 3310," 2 lines.

Catalogues and Lists.—Z Electric Lamp & Supplies Co., Ltd., 73, Newman Street, W. 1.—A showcard and folder illustrating the "Electrolux" portable cleaning apparatus.

Mr. T. L. Reed Cooper, 11, Tothill Street, Westminster, S.W. 1.—An illustrated brochure describing in detail immersible electric pumps, and giving particulars of various sizes.

National X-ray Reflector Co., Chicago (U.S.A.).—Two profusely illustrated booklets dealing with the use of "X-ray" lighting reflectors, principally for the illumination of shop windows.

The Sun Electrical Co., Ltd., 57-59, Neal Street, Long Acre, W.C. 2.—List No. 317. An illustrated folder giving revised prices of "Sunco" electric fires.

The Nuneaton Electrical Contracting Co., Ltd., Market Place, Nuneaton.—An illustrated descriptive list of new type link disconnecting boxes and service boxes. (Described in our issue of April 8th last, p. 437.)

Messrs. Johnson & Phillips, Charlton, S.E.7.—List J.B.2. A well-produced list of mining type cable boxes of all descriptions, high- and low-pressure, straight-through, 3-way and 4-way, disconnecting and non-disconnecting, dividing, &c. Details of glands and armouring clamps are also included.

Semaphore, Ltd., 2, Bayley Street, Tottenham Court Road, W.C.1.—A card giving prices of batteries for flash lamps, torches, &c.

For Sale.—Messrs. Edwards, Son & Bigwood are to sell by auction at Branston, Burton-on-Trent, surplus plant and machinery, including electrical motors, &c. For particulars, see our advertisement pages to-day.

Peterborough City Council invites offers for one overhead travelling crane, by Gibbons & Co., Ltd., [illegible] 9 in. span, to lift 6 tons.

Fire.—As the daily Press reports may convey a wrong idea of the extent of the damage, we are asked to state that the fire at the Falcon Works, Loughborough, of the Brush Electrical Engineering Co., Ltd., last Saturday, has not in the least curtailed manufacturing operations. One of the timber sheds with its stock of timber was completely destroyed, together with some log converting machines. The large stock of cars, omnibuses, and similar work in process of manufacture was unharmed. The engineering section of the works, which is away from the scene of the fire, is also intact.

The L.C.C. Turbo-Generator Contract.—With further reference to the contract recently placed with a Swiss firm by the L.C.C. Highways Committee for an 8,000-kW turbo-generator set, we have received from the British Engineers' Association a copy of a letter addressed to the chairman of the L.C.C., in which the Association puts forward the following statement:—

"The London County Council makes its purchases with public funds for the purpose of rendering public services, and if the purchases be made in this country the money expended remains here. In the case of an order for a turbo-generator, it is fair to say that at least 80 per cent. of the purchase price would be distributed amongst our own people in the form of wages and salaries. If, on the other hand, the purchase be made abroad, the money leaves this country, and in something like the same proportion is distributed to foreign labour and salaried officials. Our cost of manufacture is relatively high, because of the larger amount of purchasing power demanded by our workers in return for their production of a given commodity value. Surely the people of this country, who are themselves responsible for the high cost of manufacture, owing to their defiance of sound economic principles, should ungrudgingly pay the higher prices for the products of the home industries, which are the primary source of any well-being they have ever enjoyed or ever will enjoy. A high standard of real wages cannot continue to co-exist with discrimination, on the part of the spender, against dear home products in favour of the power-priced products of other countries where the wages cost per unit cost of value produced is substantially lower. The two conditions are mutually exclusive. Turbo-generators *are* dear in this country, but the reason is not far to seek, and our own people are in duty and honour bound to pay the higher prices which they themselves have created and which are eventually redistributed amongst them. Hoping that further consideration of the proposed transaction may result in justice being done to British labour, even at the cost of conferring some small benefit on British capital and brains."

The clerk to the Council replied to the above communication under date August 2nd, stating that the Swiss tender was some £8,000, or about 16 per cent. lower in amount than that of the lowest acceptable British tender.

This matter was raised in the House of Commons on Tuesday. In reply to a question by Mr. G. Balfour, Sir P. Lloyd-Greame (Director of the Overseas Trade Department) said that the Government had no power to interfere with the discretion of local authorities in a matter of this kind. He was informed that the British firms were invited to amend their original tenders. Mr. Balfour drew attention to the difference in hours of labour and rates of pay in this country and in Switzerland, and asked for some method of fair trade to be secured as between foreign countries and ourselves. In reply, it was stated that these considerations were present to the minds of the local authorities when placing the contracts. Another member asked whether a number of the shares in the foreign company were owned by British firms in this country, but Sir P. Lloyd-Greame replied that he did not see that that made the least difference, as the employment would go to foreign and not to British workmen. Mr. Balfour thought it a matter for broad legislation so far as securing fairer trade between home and foreign manufacturers was concerned, but Sir P. Lloyd-Greame replied that it would be obviously impossible to legislate in order to control the placing of all contracts.

Book Notices.—Publications of the Massachusetts Institute of Technology, Vol. 56, No. 30, "A Dynamometrical Comparator; a differential dynamometer for accurate comparison of alternating and direct current strengths." No. 31, "Induction Motor Core Losses." Boston (Mass.): The Institute.

"Steam Boiler Maintenance." By R. Clayton. pp. ix+118; 4 figs. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

"Principles of Radio Communication." By J. H. Morecroft, pp. x+935, illustrated. London: Chapman & Hall, Ltd. Price 45s. net.

"The Electric Furnace." By J. N. Pring, pp. xii+485; 241 figs. London: Longmans, Green & Co. Price 32s. net.

"Fifty Years of Electricity—The Memories of an Electrical Engineer." By J. A. Fleming, D.Sc., F.R.S. (384 pages and 111 plates.) London: The Wireless Press, Ltd. (To be published shortly.) This history of electrical engineering commences in 1870 and, therefore, covers practically the whole of the science and art.

The *Transactions* of the South African Institute of Engineers, Vol. XII, Part 6, June, 1921. Price 2s. net. Containing discussions on a number of papers which have recently appeared in the journal.

South African Engineers' Electrical and Allied Trades' Directory, published by the *South African Mining & Engineering Journal* in Johannesburg, and sold in this country at 82-85, Fleet Street, London, E.C.4, by Argus South African Newspapers, Ltd. 1921-22 edition. 30s.—This directory, which is quite business-like in get-up and arrangement, covers all branches of the engineering, electrical, iron, steel, machinery, constructional, automobile, hardware, and allied trades throughout the Union, Rhodesia, and Mozambique. The names of 1,500 firms appear in the alphabetical section, which is followed by a geographical section. Other features are sections giving particulars of the overseas agencies held by South African firms; a list of mining and industrial undertakings, with the names of their officials; and a list of municipalities and public supply undertakings. These and other contents should be of great use to home firms doing or contemplating export trade to South Africa.

South African Electrical Trade.—The *British and South African Export Gazette* states that the growing importance of the South African market for electrical material and machinery is demonstrated by the £1,683,112 registered for imports last year. In 1919, £972,398 worth was imported, but from 1910 until that year nothing over £550,000 had been recorded. Some £450,000 is to be spent on the Union telegraph and telephone systems this year. A substantial improvement in the business in electrical supplies may be looked for on the Rand in about two months' time, when additional power will be available.

Our contemporary also draws attention to the increased purchases of electric cooking and heating appliances which are now being made. During the first quarter of the current year imports to the value of £16,605 were registered, as compared with only £3,645 for the same period in 1920, and the demand has since been steadily increasing. "The United Kingdom, of course, now holds the bulk of this business, and is fast cutting out the United States, which last year only managed to secure £9,414 out of £41,337, as compared with £13,688 out of £23,616 in 1919."

Big Reduction in Steel Workers' Wages.—The heavy deflation of iron and steel prices is reflected in the monthly ascertainment of the Midland Wages Board. Since January the average net selling price of finished iron has fallen by over £13 per ton, and the effect of the ascertainment is to reduce ironworkers' wages by 80 per cent. as from Monday last. The decline since February is 142½ per cent. The wages of men not affected by the sliding scale are down 16s. per week.—*Financial Times.* (These percentages are based on the pre-war rates.)

Swedish Wages Reduced to meet German Competition.—Ironworkers and engineers at the Eskilstuna factory, near Stockholm, are reported to have agreed to accept reduced wages in order to meet cheap German competition and secure for Sweden a big Russian order for locomotive parts.—*The Times.*

Sheffield Rejects the German Plant Tender.—The "Daily Mail" states that the Sheffield Electric Supply Committee has decided to reject the German offer (that of the Amsterdam Corporation) to supply a 10,000-kW generating set for £50,000. The lowest British tender at current costs exceeds £90,000, and the buying of plant is to be deferred. Prices, it is thought, will have fallen enough some months hence to enable the Corporation to place the contract with a British firm.

It may be recalled that when the matter was under discussion a few weeks ago, Mr. W. L. Hichens, chairman of Messrs. Cammell, Laird & Co., Ltd., and deputy-chairman of the English Electric Co., Ltd., stated that if the Sheffield City Council was going to set an example of buying the special products of Sheffield abroad, it was difficult to see how other corporations could be persuaded not to follow its example. An ounce of practice was worth a ton of theory. High rates were an important factor in handicapping us against the Germans, and the policy of the council would appear to be to increase unemployment, and thus swell the already swollen rates. Thus they went round in a very vicious circle.

On July 13th the Sheffield correspondent of the *Financial Times* said it was unlikely that the corporation would accept the recommendation to purchase from Germany. The committee which originally made the recommendation had asked to be allowed to reconsider the matter, the chairman stating that the publicity that had been given to the proposal had done an enormous amount of good and brought British competitive prices down.

Scottish Electricians' Wages.—Throughout Scotland, meetings of the Electrical Trades Union are being held, at which the employers' new conditions are being submitted to the men. In the meantime, it is stated, the Scottish Contractors' Association have withdrawn their proposal to reduce wages by 2d. an hour from September 1st.

Cable Makers' Association.—We are notified that in the case of cable drums supplied by members of the Cable Makers' Association subsequent to August 1st, 1921, a reduction of 25 per cent. from the current prices will be allowed, and the same reduction will be allowed for all periods of hire (that is beyond the free loan period of three months subsequent to August 1st, 1921).

Excess Profits Duty.—On the application of the Monte Video Telephone Co., Ltd., the Board of Referees under the E.P.D. has increased the statutory percentage to 7½ per cent. for companies providing telephone services in Uruguay as from December 31st, 1916.

The E.T.U. and Non-Union Labour.—A recent report of the Electricity Supply Committee of the Stepney Borough Council shows that the E.T.U.'s "ban" on the connecting-up of non-union installations has been extended in another direction. The report says that cases have occurred in the borough in which the E.T.U. has given instructions that kinemas are not to be connected to the supply mains if the operators at these places are not members of the E.T.U., in spite of the fact that the installations have been executed by members of the Union. Apart from this, music halls are also affected. One case, in which legal proceedings against the Council are threatened, is that of the Royal Cambridge Hall. Although the wiring, &c., was carried out by E.T.U. members, connection is refused on the ground that several employés at the theatre are not members of the National Association of Theatrical Employees. The installation contractors are unable to carry out final tests, and until they do the proprietors of the theatre will not pay the account, and in consequence are threatened with legal action. In turn the proprietors also intend to sue the Council if the necessary connections are not made. The London District Organiser of the E.T.U. expresses regret that the "ban" cannot be removed, "as this is a trade dispute which involves fundamental principles for the trade-union movement." The committee is of the opinion that the matter should have been raised before the wiring was carried out. It is also stated that this is not an isolated case. The committee recommends "That the Council do authorise the Borough Electrical Engineer and Manager to give the necessary instructions to the Council's employés requiring them forthwith to connect up the 'Royal Cambridge Music Hall' with the Council's mains and to maintain such supply when connected, and also to give similar instructions with regard to supplies to other places of amusement."

Four Years' Electrical Progress in Russia.—In a long descriptive article on the progress of electricity in Russia since the revolution, the *Novy Mir* summarises in tabular form the results alleged to have been attained, as follows:—In the year 1917, four town stations of 2,421 kW and two village stations of 59.2 kW were opened; in the year 1918 six town stations and two village stations were opened, totalling 4,704 kW and 53.4 kW respectively. The corresponding figures for 1919 were 24 town stations and 12 village stations, or 1,305.3 and 342.7 kW respectively; in 1920, 47 town stations and 53 village stations, of 7,670 kW and 1,029 kW respectively. Progress appears to have slowed down in 1921. As far as it has gone, the year shows only 22 new town stations and 17 new village stations, the respective total powers being 1,683 kW and 320.6 kW. It is pointed out that powerful new stations are being built, and old ones are being enlarged in five governments, in of any form of trade which private enterprise could carry on, and asking for the discontinuance of operations by the Electricity Department in the sale of electrical appliances, &c.

Wolverhampton Contractors' Protest.—At a meeting of the Town Council on August 3rd a letter was read from Mr. Ellis Aldridge, an electrical contractor, enclosing a resolution passed by a well-attended meeting of electrical engineers and contractors protesting against competition carried on by the Wolverhampton Electricity Department. The matter was referred to the Electricity Committee, as also was a protest from the local branch of the Middle Classes Union. That organisation sent a resolution protesting against the municipalisation of any form of trade which private enterprise could carry on, and asking for the discontinuance of operations by the Electricity Department in the sale of electrical appliances, &c.

Annual Outings.—The employés of the Hart Accumulator Co., Ltd., of Stratford, held their twenty-fourth annual outing on Saturday, July 23rd, going by charabanc to Southend. The party was photographed during a halt at Brentwood. Dinner was served at the Maisonette Café, High Street, Southend. The toast of the Hart Accumulator Co., Ltd., was proposed by the chairman (Mr. F. J. Holmes, M.I.E.E.), manager of the company, who in a few well-chosen words referred to the difficult times caused by trade depression, the coal strike, &c., through which the company had safely passed, and urged upon the employés the necessity for taking their share of hard work to enable conditions to become more normal. Mr. C. Cartwright (vice-chairman) proposed the toast of "The Chairman," which was suitably respondeu to. Thanks were expressed to the committee who organised the successful outing, and to Messrs. W. McDonald and C. Cartwright, who acted as hon. secretary and treasurer respectively.

The annual outing of the employés of Messrs. Higgins and Griffiths, Ltd., took place on July 9th. The party, accompanied by Mr. Albert Higgins, one of the principals, left Paddington for Windsor, whence by private launch they were conveyed to Cookham and district. The river trip was much enjoyed. Luncheon and tea were served on board to the strains of music provided by an orchestra. Toasts were given by the president, and were suitably responded to. At Cookham, sports occupied attention, and the party then returned to Windsor, where, during a concert interval, the sports prizes were presented. Mr. J. Ansell organised the arrangements with the assistance of Mr. Barclay, treasurer.

On Saturday last the staff and employés of Messrs. Robson & Coleman, of Newcastle-upon-Tyne, went for their annual excursion to Warkworth by charabanc. The party arrived there about midday, and after lunch, games and sports were entered into. A company numbering over 100 sat down to tea, after which prizes, provided by Mr. and Mrs. Robson and Mr. Ridley, were presented to the fortunate winners in the Castle Grounds.

The Electrical Contractors' Association.—The August number of *The Electrical Contractor* records the election of Mr. Orringe as President and the re-election of Mr. H. Marryat as hon. treasurer. The following committees have been appointed (chairmen's names are given in parentheses): Propagandist (Mr. W. A. Shaw); Law and Parliamentary (Mr. W. Cross); Apprenticeship (Mr. A. E. Chesters); I.M.E.A. and Registration (Mr. H. J. Cash); Finance (Mr. Orringe); Trading (Mr. Heywood); *Electrical Contractor* (Mr. Baxter).

Contemplated Withdrawal from Industrial Council.—The Transport and Electricity Committee of Newcastle-on-Tyne Corporation has decided to hold a special meeting to consider the advisability of withdrawing from the National Wage Agreement and the Industrial Council, as it is not satisfied that the reductions, &c., proposed are adequate to meet the circumstances, having regard to what has been done in other industries.

"Whirlwind" Advertising.—The Portable Utilities Co., one of whose specialities is the "Whirlwind" suction sweeper, conceived the idea of bringing to life a familiar figure in its advertisements of the appliance. Accordingly a lady dressed in a costume on conspicuous lines—spiral lines suggestive of a whirlwind, and equipped with an umbrella also bearing a spiral design and an announcement—was engaged to promenade the streets of a well-known seaside resort. The electrical dealers of the town co-operated with window displays, and excellent results are anticipated.

British Industries Fair.—Correction.—In our issue of July 29th we gave the address of the General Manager of the British Industries Fair (Birmingham) as 73, New Street; the correct address is Chamber of Commerce Buildings, 95, New Street.

An Electrical Conference in France.—The Union des Syndicats de l'Electricité is arranging an international conference in Paris in October for the discussion of all problems relating to the transmission of electricity in bulk. The conference will probably last three of four days and the opening is fixed for the 20th. At least three delegates will be invited from each country to attend the conference. The official address of the Union is 7, Rue de Madrid, Paris.

Inquiries.—The makers or agents for the following devices have been asked for: Induction coils for "Stecophone" telephones; the Rotaplunge pump.

Sterling Dispute Settled.—The dispute between the Sterling Telephone & Electric Co., Ltd., and its skilled employés has now been settled, and the works re-opened on the 9th inst.

German Exports.—The quantity of machinery, electrical manufactures and motor vehicles exported from Germany in 1920 is now officially returned at 672,611 tons, of the value of 11,270,005,000 marks.

Dublin Electricity Staff Re-organisation.—A Re-organisation Committee on Civic Administration, appointed by the Dublin Corporation, recommends that electrical work carried out by the Council be entrusted to the electricity supply staff; that the Town Clerk, as *ex-officio* secretary of all committees, should have direct supervision of the correspondence of the electricity department; also that the appointment of Mr. F. J. Allan, as secretary of the Electricity Supply Committee, be determined, but that, pending a report of the committee on the proposed re-arrangement, he should continue to act in the capacity of commercial manager of the undertaking.

Wages Reduction.—The Darlington Town Council has approved a reduction in the wages of workers in the electrical, tramway and gas departments by 6s. 9d. per week, to be taken off in two instalments.

German Tubing Manufacturers Combine.—Under the name Verband Deutsche Isolierrohrwerke, a union of fourteen of the principal manufacturers in Germany of insulated tubing has recently been formed in Hagen.

New French Company.—A new company has lately been formed in Paris (45 Avenue de Friedland) with a capital of 1,000,000 fr., and the title La Société La Radiotechnique.

LIGHTING AND POWER NOTES.

Aberfeldy (Perthshire). — Electricity Scheme. — Provost Haggart, who has recently purchased the town, has decided to carry out an electricity supply scheme, although he is chairman of the local gas company.

Accrington.—Important Supply Contracts.—The Electricity Committee has had several applications for supplies of power in considerable quantities. Messrs. Steiner & Co., of Church Docks, desired a night load of 900,000 units per year. A cable was necessary, and the engineer was instructed to interview the firm thereon. The Phœnix Chemical Co. asked for special terms for a continuous night and day supply. Subject to its taking 150,000 units per month for 12 months, with an equal load night and day, the committee agreed to supply at 1.75d. per unit. Messrs. Howard & Bullough, in agreeing to take a minimum of 15,000 units per month, were also quoted a special price.

Blackburn.—Loan.—The Town Council has decided to borrow £221,500 in connection with the new generating station at Whitebirk. It was also decided to convene a special meeting to approve a scheme for the supply of electricity to Great Harwood, Rishton, Wilpshire, Clayton-le-Dale and Ramsgreave.

Blackpool.—New Sub-station.—The borough electrical engineer has recommended that, in order to meet the increasing demands on the electricity service, an underground transformer station be constructed in Abingdon Street. The Electricity Committee has approved the recommendation.

Blackrock (Co. Dublin).—Proposed Large Station.—At a meeting of the Urban Council, the manager of the Irish Overseas Trading and Engineering Association brought forward a proposal for the erection of a large capital power station for generating and distributing electricity for lighting and power over a wide area. With modern machinery and a really up-to-date plant, it was stated, the Association should be able to distribute electricity at a price below that at which the Council could generate it. The Association intended to secure a concession for a peat bog, and use the peat as fuel. The matter was referred to the Council's Electric Light Committee for consideration, and the surveyor was directed to give the Association particulars of a scheme which the Council had in view.

Canada.—Hydro-electric Development.—A recent review of hydro-electric progress published by the Department of the Interior (Water Power Branch) states that plant of 560,000 h.p. capacity was installed or under construction during the past year. The capital sunk in hydro-electric enterprises has reached a total of $475,000,000. An annual saving of 18,500,000 tons of coal is made; this represents a sum of $148,000,000. It is stated that the 2,470,580 h.p. already installed is only about 6 per cent. of the available water power according to recent surveys. The resources of Quebec seem to be the greatest, but the most advanced development is in Ontario.

Cookham.—Electricity Scheme.—The Town Council has received notice of the intention of the Rt. Hon. the Lord Miston, K.C.S.I., and others to apply to the Electricity Commissioners for a special order to authorise them to generate and distribute electricity within part of the parish of Cookham, being part of the area of the undertaking of the Maidenhead Corporation, and repealing the powers granted to the Town Council to supply electricity within the area. The Council has decided to offer no objection to the application.

Caterham.—Proposed Price Increase.—The Urban Electric Supply Company has applied for an order to increase the maximum price of electricity from 10d. to 1s. 2d. per unit as from September 30th next, and the minimum quarterly payments from 12s. 6d. to 17s. 6d. in the winter quarters, and from 8s. 4d. to 11s. 8d. in the summer quarters.

Cavan.—Lighting Contract.—The Urban Council has accepted a seven years' agreement with the local Electric Lighting Co. for the lighting of the town. The price per unit is fixed at 1s.

Ellesmere Port.—Bulk Supply.—In reply to a letter of the Electricity Commissioners regarding the withdrawal of the Council's Electric Light Order, the Ellesmere Port and Whitby Council has protested against its exclusion from the Mersey and West Lancashire Electricity District, but states that it is prepared to take a supply from the Mersey Power Co. in bulk for all purposes at a price to be agreed, or failing an agreement, as may be determined by the Electricity Commissioners, this arrangement to remain in force until the Joint Electricity Authority for the Merseyside and West Lancashire Electricity District is in a position to offer a cheaper supply to the district, or such other period as the Electricity Commissioners may determine.

Edinburgh.—Price Increase.—The Electric Lighting Committee has decided that it will not be necessary to increase the charges for power, but the charge for lighting has been increased from 4¼d. to 4½d. per unit.

Exmouth.—Company's Proposals.—On August 3rd the General Purposes Committee reported the receipt of a letter from the Electric Supply Corporation asking whether the Council would agree to cancel the agreement of 1903 and support the Corporation's application for a Provisional Order constituting itself the undertaker, containing a purchase clause as favourable to the Council as the purchase clauses in the agreement of 1903, and providing for a maximum price of 1s. per unit. The Corporation would be prepared to bear the Council's reasonable charges. The committee stated that it would make a recommendation later. The matter was referred to the Finance Committee.

Gloucester.—Temporary Price Increase.—The City Council is applying for permission to increase charges temporarily in order to recover the financial loss incurred during the coal dispute.

An additional feeder is to be laid in the Bristol Road district, at an estimated cost of £3,000, to meet increased demands.

Keith.—Proposed Electricity Scheme.—A committee appointed by the Town Council to consider the possibility of a municipal electricity supply scheme has made its report. The committee has examined installations in towns of similar size, and has made a partial canvass among the inhabitants, and both items are regarded as satisfactory. The motive power recommended is either suction gas, oil, or wind power. The report was "received," and will be considered at this month's meeting.

Lanarkshire.—Electricity Supply.—The County Council Electric Lighting Orders Committee, having considered the question of providing supplies of electricity to the districts of Strathaven and Law, as well as to the county in general, is of the opinion that an application should be made to the Electricity Commission for a Special Order. The clerk is to confer with the Clyde Valley Electrical Power Co. as to the possibility of supplies being obtained for portions of the county for which orders have not yet been made.

Lurgan.—Extensions.—The Electric Light Committee's recommendation for the extension of cables in various thoroughfares was adopted by the Urban Council, and it was intimated that a report would be made soon on the question of raising funds for extension of the works.

Monmouth.—Suggested Combination.—According to the *Hereford Times*, it was stated at a recent meeting of the Monmouth Town Council that electric light standards were being erected by Hereford within five miles of Monmouth. The clerk suggested that the two undertakings might be combined by the taking over of the Monmouth station by the Hereford City Council. A deputation was appointed to meet the Hereford Council to discuss the subject.

Northwich.—Application for Order.—The Electric Supply Co., Ltd., has applied for an Order to supply electricity in the rural district of Northwich and the parishes of Aston-by-Budworth, Pickmere, Tabley Superior, Tabley Inferior, Plumbley, Bexton, Toft, Lower Peover, Mobberley, and the urban districts of Northwich, Middlewich, Winsford, and Knutsford.

Portrush.—Proposed Price Increase.—The Urban Council is applying for permission to increase the maximum prices of electricity as follows: For any amount up to 20 units, £1 6s. 8d.; for each unit over 20 units, 1s. 4d. At present the maximum amount chargeable is 8d. per unit.

Sleaford.—Proposed Price Increase.—The Urban District Council has applied for an order permitting it to increase the maximum price of electricity from 8d. to 11d. per unit.

Southend.—G.E.R. Supply.—At a meeting of the Electricity Committee an inquiry was submitted from the chief engineer to the Great Eastern Railway Co. stating that the company was considering the question of lighting by electricity the whole of the station premises, goods sheds, signal boxes, &c., on the companys property in the borough, and asking the terms upon which the Corporation would be prepared to supply energy for the purpose indicated for an estimated minimum consumption of 14,500 units. Instructions were given to the electrical engineer to confer with the company on the matter, and to report to the committee in due course.

Loan Inquiry.—On July 30th, Col. T. C. Ekin, on behalf of the Electricity Commisioners, held an inquiry into the circumstances in which the Council has applied for sanction to a loan of £114,873 for electricity purposes. Evidence was given as to the growth of the demand and number of consumers, special reference being made to the development of Leigh, where 1,080 kW of plant had been installed. The Inspector was satisfied that additional plant was necessary and, after inspecting the plant, closed the inquiry.

St. Annes.—Supply to Lytham.—The Urban District Council has appointed a sub-committee to confer with the Lytham Urban District Council on the question of an immediate supply of electricity to Lytham. The two districts expect to be incorporated as a joint borough next year.

South America.—Water Power.—The *Economic Review*, quoting *Technik und Wirtschaft*, says that the entire economic development of Latin-America depends upon the possibility of its becoming independent of coal. This possibility is given by the possession of water power. In the Iguazu, the continent possesses the greatest waterfall of the world, surpassing in power the falls of the Zambesi and Niagara. Its exploitation has only been prevented hitherto by its unfavourable situation. To conduct electric power from it to the industrial centres of Argentina would mean traversing hundreds of km., and for Brazil, which lies on the other bank of the Iguazu, conditions are not much more favourable. Brazil is, however, carrying on her economic development by means of the Government settlements along the bank of the Iguazu, and this development will be accelerated if the contemplated, strategically important railway to the Paraguay-Argentine frontier in the vicinity of the fall materialises. Quite apart, however, from the Iguazu, most of the South American Republics possess vast, still unexploited, sources of energy in hundreds of rivers, waterfalls and rapids.

Sevenoaks.—Price Increase.—The Electricity Company has asked the Urban District Council for permission to increase the charges under an agreement for the supply of electricity; in the case of public lighting from 2d. to 4½d. per unit, and for other purposes from 4d. to 8d. A recommendation that the company be offered 50 per cent. increase on the charges laid down in the agreement was referred back.

Teesdale.—Proposed Electric Light Scheme.—At a meeting of local authorities at Barnard Castle, the practicability of providing electricity to the Tees valley district was discussed, and it was finally decided to ask representatives to secure the financial support of their respective councils. The possibility of employing water power is being considered.

Tunbridge Wells.—Loan.—The Town Council has applied for a loan of £7,500 for the construction of a water tower, interconnecting pipe-work, &c., at the electricity works.

Torquay.—Smoke Nuisance.—Complaints have been made regarding the smoke from the electricity works. It was stated at a meeting of the Council that a private firm had offered to install smoke-consuming apparatus free of charge. The matter was referred to the Electricity Committee for report.

Wolverhampton. — Anticipated Developments. — The borough electrical engineer recently stated that the electricity undertaking would be fully loaded in a year or eighteen months' time. He considered that when the existing station had been extended to the utmost limit, the demand would be too great for it by 1927, and a new station would have to be erected. Under the proposed joint scheme, in which Stoke-on-Trent, West Bromwich, Stafford, the Midland Electric Corporation and others would participate, it was estimated that the Corporation would effect a saving of £250,000 by taking a supply from the Joint Authority instead of erecting a new station.

The Town Council has decided to support the Joint Authority scheme.

TRAMWAY AND RAILWAY NOTES.

Barrow-in-Furness.—Track Repairs.—The tramway manager has reported that car failures have occurred owing to the defective state of the permanent way, and urged that the cost of maintenance of cars must be heavy until the points, crossings, and rail corrugations have received attention. On the recommendation of the borough surveyor it is proposed, in order to improve the track, to accept a quotation of the Rail Welding Co., Ltd., to deal with about 500 joints by electric welding.

Belfast.—Year's Working.—The accounts of the tramway undertaking for the year ended March 31st, 1921, record a total revenue of £601,184, as compared with £545,348 in the preceding year. Working expenses totalled £503,555, as against £379,088, leaving a gross balance of £97,629, a considerable decrease from that of the previous year—£166,260. Capital charges were considerably greater, causing a net deficit of £39,635. In the period 1919-20 there was a net profit of £35,150. One factor, stated to have contributed to this loss, was the military "Curfew" order. The number of passengers carried was 100,643,705, an increase of about 5,000,000. The number of car-miles run rose from 6,276,133 to 6,313,203. While the receipts per car-mile increased by 2d., working expenses rose by 4.65d.

Bournemouth.—Fare Increase Agreement.—An application by the Corporation for permission to increase fares has been assented to by Poole, which has agreed that the present differential system of services and fares shall be abolished in favour of equal rates throughout the two systems. Bournemouth holds the Poole system on a lease.

Brighton.—Year's Working.—The annual report of the manager of the Corporation tramways shows that the total revenue for the year ended March 31st last was £131,478, as compared with £116,839 in 1919-20. Working expenses amounted to £110,675, as against £97,924, leaving a gross trading balance of £20,803 (£18,915). After payment of capital charges a balance of £2,386 remained. Provision for renewals absorbed £22,800, leaving an excess of expenditure over income of £20,414. Although the total car-miles run increased from 1,203,961 to 1,273,787, the number of passengers carried fell from 20,441,351 to 16,268,035. Only the increased fares prevented a heavy fall in receipts.

Doncaster.—New Route.—The Town Council has approved a proposal of the Tramways Committee to apply to the Light Railway Commissioners for an Order under the Light Railways Acts to lay a circular tramway track in French Gate, St. Sepulchre Gate, Factory Lane, and Trafford Street to North Bridge Road. Instructions have been given for the laying of the track in Trafford Street in anticipation of receipt of the Order.

Exeter.—Proposed Sale of Undertaking.—A communication from the National Electric Construction Co., Ltd., with regard to the sale or lease of the tramway undertaking has been deferred by the Tramways Committee until the city treasurer has reported upon the financial aspect of the company's proposals.

Gateshead-on-Tyne.—Option of Purchase.—At a meeting of the Town Council on the 3rd inst., it was decided not to exercise the option of purchase of the tramway undertaking next year. The matter had been considered by the Parliamentary Committee, which estimated that the sum required to purchase the system would approximate to £500,000, and about £24,000 a year would be needed to meet the interest upon the borrowed money.

Halifax.—Permanent-way Engineer.—The Town Council has approved a recommendation by the Tramways Committee that a permanent-way engineer be appointed, at a commencing salary of £350 per annum. The acting chairman of the Tramways Committee said the new appointment was proposed in view of the tramway manager's report, and in view of the great amount of work involved; they anticipated considerably more work in reconstruction than in recent years.

London.—Earlier "Underground" Trains.—Commencing on August 8th, the Underground Railways Co. has instituted a number of earlier trains. Full details have been published, and may be obtained at any of the company's stations.

Newcastle-on-Tyne.—Result of Inquiry.—The town clerk has received an intimation that the Light Railway Commissioners, who held an inquiry on July 22nd into the City Council's application for permission to construct a light railway through Gosforth Park, have determined the expediency of granting the application, and have satisfied themselves as to compliance by the Corporation with the requirements of the Light Railways Acts, subject only to the passing of a formal resolution by the Council upon the matter. This resolution will be submitted to the Council on September 7th.

North Shields.—Inquiry into Accident.—On August 4th, Major G. L. Hall, R.E., held an inquiry into the fatal tramcar accident reported in our last issue. Evidence was given as to special instructions to drivers drawn up after a previous accident at this place. The conductor of the overturned car, who had only been employed for a month, stated that he did not

remember reading any instructions to conductors as to the action to take when a driver was in difficulties. The inspector asked if the car was pulled up at the top of the bank or at the bottom end of the curve, a compulsory stopping place, but the witness could not give a definite reply beyond stating that he was sure the driver pulled up to a very low speed. He did not remember which brakes the driver used at the time. He did not ring his bell at the bottom of the curve as this was a compulsory stopping place, but he blew his whistle when the car had passed the spot and was gathering speed. Witness said he had not received any instructions regarding the handling of the brakes or sanding gear. The driver said he had been in the company's service since January 1st this year. On the day in question he pulled up at the first compulsory stop, but passed the second because the wheels "picked up." He applied the hand brake and, partially, the slipper brake, because the track was greasy; he also sanded the track. In spite of the use of the brakes the car continued to travel at an excessive speed. He could not account for the overturning of the car. After further evidence the inquiry was closed.

Walthamstow.—Railless Traction.—The Council has pronounced in favour of a railless electric traction system for the district.

TELEGRAPH AND TELEPHONE NOTES.

France.—Submarine Telephony.—A device by which, it is claimed, it will be possible to "harness telephone lines to submarine cables" has been invented by MM. Gaston Vincent and Louis Duverger, two French engineers.

According to *The Times*, the French Government has sanctioned experiments with the invention during the next fortnight over the submarine cable between Antibes, near Cannes, and Saint Florent, Corsica. Although this cable is in a state of disrepair and has been disused for telegraphic purposes for some time, the inventors are confident of success. The cable has a length of only 125 miles, but it is claimed that the new principle can be applied to all existing submarine cables.

Fac-simile Writing by Wireless.—Last week *Le Matin* of Paris published an account of a wireless message received from the *New York Times* in which the handwriting of the sender in New York was reproduced clearly in Paris. The *Daily Telegraph* says that the actual words of the message were transmitted in a few minutes exactly in the form in which they were written (the inventor of the appliance by which it was accomplished being a French engineer, M. Belin), and goes on to explain that the exactly analogous appliance for the transmission of handwriting and pictures over ordinary telegraph lines, which has been available for some years, has not been largely employed on account of the distortion produced by atmospherics and stray currents. Signor Marconi recently announced the discovery of a method of screening such interferences, which method, however, is still in the laboratory stage.

The Telegraph Service.—Deferred Press Service.—The P.M.G. gives notice that from August 8th the deferred Press service at the rate of 2½d. per word will be restored between the United Kingdom and Canada, "*via* Imperial" only.

Mr. Pike Pease, assistant P.M.G., in reply to questions in the House of Commons, has circulated the following tabular statement comparing the number of and revenue from ordinary inland and Press telegrams during the six months ended June 30th, 1921, with the figures for the corresponding periods in 1919 and 1920:—

Ordinary Inland Messages.

Year.	Number.	Revenue.
1919	34,737,000	£1,602,250
1920	34,329,000	£1,544,897
1921	27,172,000	£1,757,926

Press Messages.

1919	1,470,000	£44,570
1920	1,374,000	£64,426
1921	1,398,000	£67,241

The Telephone Service.—The Money Bill.—On the motion for the second reading of the Telegraph (Money) Bill in the House of Commons on August 7th, Mr. Kellaway, P.M.G., explained that the £5,000,000 for which the Bill made provision would last till the end of April next, by which time he hoped the House would have before it the report of the Select Committee on Telephones. The money was not needed for new work, but for the completion of contracts which had been made and work already in progress. Much had been done to overtake arrears and, although they had now 23,000 applications which they could not entertain, at this time last year, they had refused 35,000 applications. The new exchanges covered the country generally, and if they were to meet the increasing demand plant must be available. The three main trunk routes of the cable system from London were rapidly nearing completion, and there was a marked diminution of the calling-up time in the trunk service, no doubt due to the trade depression and revised rates having reduced the number of calls. Generally, there had been an improvement in efficiency; the time taken in answering calls in London had been reduced from 7.5 secs. in May, 1920, to 5.3 secs. in May, 1921. He wished that the financial situation of the country made it possible to go in for a large extension of the automatic telephone system because, although it did not effect anything like the saving in working costs which was generally supposed, it got rid to a great extent of the human factor. But the automatic system entailed a very heavy capital expenditure, and in the present condition of the country's finances he did not think that he would be justified in asking the House to agree to great expenditure on installing the system. There were some 13 automatic exchanges at work in the country, and they were proving very satisfactory. He hoped that before long it would be possible to lay before the House proposals for introducing the system into London. Mr. Kellaway fully realised the necessity of doing everything possible to develop the telephone system in rural districts, but the great difficulty was the disinclination on the part of the residents in those districts to accept a party line system, such as that which was in operation in Canada and in America.

Mr. Pike Pease, Assistant Postmaster-General, said that new exchanges had been opened at Perth, Carlisle, Liverpool Central, Huddersfield, West Bromwich, and Northampton. Exchanges in replacement of worn-out exchanges had been completed at Leith, Bristol, Lincoln, Derby, Birmingham, and Hove. A number of applicants for telephones could not be supplied owing to shortage of plant. The number of new exchanges was 54, and 35 exchanges had been ordered but not yet completed. In 46 other places equipments were in course of design, and 235 others were earmarked for extension or replacement at an early date. In January last year 40,000 lines were lost in two hours in a snowstorm, and it was plainly in the interests of the service to put the lines, if possible, underground.

Wireless Telegraphy.—Imperial Chain.—The Imperial Conference of Prime Ministers has endorsed the scheme proposed by the Imperial Wireless Telegraphy Committee, with some modifications. Australia has withdrawn from the scheme, but promises co-operation. Australia would be the last to receive messages, as there would be three or four retransmissions on the way, and Mr. Hughes considers that there can be direct communication, at any rate for short periods each day, between Australia and England, or through one intermediary station. Mr. Hughes on his return will put the matter before the Australian Parliament, which will be free to adopt any scheme, and Australia will take the financial responsibility.

New Zealand was not included in the list of stations outlined in the Norman Report, and Canada was also omitted. South Africa does not really form part of the Imperial chain, of which it is an offshoot. The chain is, therefore, curtailed to about one-half of the Empire, including transmission across the Atlantic, for which, however, a receiving station has not been planned. Existing stations in Canada are the property of companies.

The Post Office is to be the wireless authority for this truncated scheme. In order to expedite the construction of the stations, it is proposed to standardise all the engineering parts. The withdrawal of Australia will increase the loss which will fall upon the Post Office, the Indian Government, and the Crown Colonies by more than one-fifth. The estimated cost of each station is £185,000. The scheme does not provide for the erection of any high-powered station comparable to those now operating between the Continent and the United States or between France and the Far East.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—Sept. 28th. Victorian Government Railways. Lifting magnet and generating set with control apparatus and accessories. (Contract No. 34,241.)*

Queensland. — P.M.G.'s Department. — November 5th. Bronze wire, Schedule 536. (July 29th.)

Belgium.—August 17th. The Belgian Ministry of National Defence. Supply of 5,000 three-electrode valves for the military wireless telegraph service. Tenders to the Third Direction Générale du Ministere de la Defense Nationale, 10, Rue du Meridien, Brussels.

August 25th. Municipal authorities of Schaerbeek, Brussels. Alterations to the existing static transformer boxes and the "repartition" box, and for the construction of two additional static transformer boxes. Copies of the plans and specifications (2½ fr. each) from the Caisse Communale. Also supply of electricity meters. Particulars (1½ fr.) from the Caisse Communale. Tenders are to be addressed to the Administration Communale, Schaerbeek.

September 2nd. Provincial Government of Limbourg. For the establishment of an electricity distribution system between Beeringen-Bourg Leopold, Tessenderloo, Beeringen and Zon-

hoven. Copies of the plans and specifications may be obtained from 99, Rue des Flamands, Louvain, or they may be inspected up to August 29th at the offices of the Provincial Government at Hasselt, where also on Tuesdays those desiring further particulars can make individual inquiries. Tenders are to be on special forms and enclosed in double envelopes, the outer one to be sealed and marked "Offre pour l'Entreprise de l'Etablissement d'une partie du Reseau de Distribution de l'Energie Electrique dans le Limbourg."

Belfast.—August 22nd. Electricity Department. One 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced-draught fans. Four fuel economisers. Two steel chimneys, with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (July 22nd.)

Coventry.—September 1st. Electricity Department. Two 10,000-kW, 3-phase turbo-alternators, complete with condensing plant; four water-tube boilers with chimneys, superheaters, mechanical stokers, economisers, and all accessories. (July 29th.)

Horsham.—August 27th. Electricity Department. One circulating water pump, one steam ejector air pump, one water extracting pump, complete with driving units or, alternatively, a centrifugal circulating water pump, one Edwards air extraction pump, complete with driving units; 1,000 yards l.p. feeder cable, .15—.075—.15 sq. in. area; 1,000 yards 3-core pilot cable, .003 sq. in. area. (See this issue).

India.—High Commissioner for India.—August 30th. Telegraph cable. (See this issue.)

London.—L.C.C.—September 5th. H. and l.p. switchgear for sub-station. August 5th.)

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

Paddington.—August 22nd. G.W. Railway. Three months' supply telegraph instruments, electrical apparatus, wires, cables, telegraph ironwork and tools, and drysalteries. (See this issue.)

Manchester.—Lessees of the City Hall. Tenders to undertake the electrical work for all exhibitions to be held in the Hall. The Lessees Provincial Exhibitions, Ltd., 60, Corn Exchange Buildings, Fennel Street, Manchester.

South Africa.—Pretoria.—October 4th. Electric Light and Power Department. Coal-handling plant, 6,600-V cables, induced-draught and ash-handling plant, pumps, piping, &c.—Mr. T. C. Wolly Dod, General Manager, Municipal Electricity Supply, P.O. Box 423, Pretoria.

Durban.—August 31st. Corporation. One 3,000-kW, three-phase, 50-period, 6,600-V turbo-alternator wth condensing plant, circulating water pump and piping. (See this issue.)

September 28th. Corporation. Two 500-kW rotary converters, switchgear, and automatic controlling devices, also h.p. supply feeders.*

Sale.—Urban District Council. Cables, transformers, switchboards, house meters, and a.c. motors. (See this issue.)

Southampton.—August 30th. Electricity Department. E.h.p., 3-phase cable. (See this issue.)

Stockton-on-Tees.—August 31st. District Fund, Gas and Electricity Committees. Articles and stores for six months. (August 5th.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

*** A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.**

CLOSED.

Crook (Durham).—Electrical installations in 228 houses (housing scheme).—G. Morrison, Blackpool.

Hastings.—Town Council. Accepted:—

Fawcett Construction Co., Ltd.—Alterations, &c., to buildings, £11,191; platforms, galleries, ladders, &c., £736.
Brush Electrical Engineering Co., Ltd.—1,125-kW Brush-Ljungstrom turbo-generator plant, £17,705.
Bumstead & Chandler, Ltd.—Centrifugal pump engine and tachometer, £864; 34-b.h.p fan engine, £4,020.
Stirling Boiler Co., Ltd.—Stirling water-tube boilers, "A" type, under-feed stokers, Crosby water regulators, foundations, flues, coal chutes, and Lea coal meters, £10,085.
Acton & Co., Ltd.—Steam and water pipes and valves, Lea recorders, and Holden & Brooke feed-water heater, £3,198 13s. 6d.
Holden & Brooke, Ltd.—No. 10 high-velocity heater, £149.
Ferguson, Pailin, Ltd.—Switchgear, £967.
Premier Cooler & Engineering Co., Ltd.—Forced draught cooling tower, £1,880.

Manchester.—Tramways Committee. Accepted:—

Silicium bronze trolley wire.—F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.
Steel tramway poles.—J. Spencer, Ltd.

Baths and Wash-houses Committee. Accepted:—

Electric lighting installation at Levenshulme Public Wash-house.—Alliance Electric Co.

Education Committee. Accepted:—

Installation of electric light.—Plymouth Grove School: A. Harrison. Upper Jackson Street School: Garner, Holt & Co.

Electricity Committee. Accepted:—

Cable.—Western Electric Co., Ltd.; Johnson & Phillips, Ltd.
Supplies of cable for six months.—British Insulated & Helsby Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Enfield Ediswan Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros & Co., Ltd.; Western Electric Co., Ltd.

Stores for six months:—

Adhesive tape.—W. T. Henley's Telegraph Works Co., Ltd.
Blackley tape.—Connolly's (Blackley), Ltd.
Dry batteries for flash lamps.—Siemens Bros. & Co., Ltd.
Box compound for e.h.p. work and bittite tape.—Callender's Cable & Construction Co., Ltd.
Box compound (for l.p. work) and resin oil.—Dussek Bitumen Co.
Carbon brushes.—Le Carbone; Morgan Crucible Co., Ltd.
Dynamo brushes and copper tape brushes.——Wm. Patterson, Ltd.
Earthenware pipes and bends.—Doulton & Co., Ltd.; Isherwood Bros., Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Gaskell & Grocott; Taylor, Tunnicliffe & Co., Ltd.
Fuse boxes.—Siemens Bros. & Co., Ltd.
Lion jointing and packing.—Jas. Walker & Co., Ltd.
Rubber tape.—L. Andrew & Co.; Callender's Cable & Construction Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Service boxes.—Forrest & Sym; Hardy & Padmore, Ltd.; Jos. Stubbs, Ltd.
Auto-balancers and auto-transformers.—General Electric Co., Ltd.
Trifurcating boxes.—British Insulated & Helsby Cables, Ltd.; Johnson & Phillips, Ltd.
Tubing, &c.—Brotherton, Ediswan Tubes & Conduits, Ltd., and Simplex Conduits, Ltd.
D.C.C. wire.—London Electric Wire Co. & Smiths, Ltd.
Tin fuse wire.—Connolly Bros. Adhesive Tape & Insulating Co.
Tinned copper and tin fuse wire.—Hawkins Bros. & Co., Ltd.

Stepney.—Electricity Department. Recommended:—

Half mile 3-in. conduits, £135.—Albion Clay Co., Ltd.
Meters and combined meters and demand indicators.—Aron Electricity Meters, Ltd., combined meters and demand indicators. Recommended.
The supply of meters (50 and 100 amps).—Ferranti, Ltd. Recommended.
Meters (3½ and 25 amps).—Reason Manufacturing Co., Ltd. Recommended.
Eighteen circuit breakers, £289.—G. Ellison. Accepted.
Five-ton lift, at Osborn Street sub-station, £1,395.—Marryatt & Scott. Recommended.
Steelwork for flooring of stores at Osborn Street.—Drew-Bear, Perks & Co., Ltd., £872. Recommended.
Nine line reactance coils at Limehouse generating station, £1,464.—British Thomson-Houston Co., Ltd. Recommended.
Two additional circuit breakers, for use on the converters at Osborn Street sub-station, £164.—G. Ellison. Recommended.

Salisbury.—Joint Isolation Hospital Committee. Accepted:—

Salisbury Electric Light & Supply Co., Ltd., for renewing the battery at the hospital and putting it in working order, at £198.

Wolverhampton.—Town Council. Accepted:—

Underfeed Stoker Co., Ltd.—£741 for 8 hoppers with special guides, rack, and pinion, and controlled double doors.

NOTES.

The Ramsay Memorial Fund.—A new scholarship has just been created in connection with the Ramsay foundation in France. It is recommended that the French candidate shall be a post-graduate research student and undertake research work on problems connected with chemistry and engineering at a school in the British Empire which he may select with the approval of the trustees.—*Reuter.*

Fatalities.—On July 31st, at Hayle, William Mills, a linesman employed by the Cornwall Electric Power Co., came into contact with a "live" cable, and the shock made him fall from a standard, with fatal results.

On August 5th, William Tomkins, a plumber, was employed at the top of a ladder when his head came into contact with an electric cable, burning his ear and rendering him unconscious. Artificial respiration was tried without success.

A New Method of Barge Propulsion.—A Reuter message from New York outlines a rather complicated method, devised by a New York engineer, of propelling a number of barges. A generating plant is installed in one boat and transmission cables from this provide power to motors on individual barges. It is suggested that the motors being identical in type and the power constant to each, the barges will move as a unit, and there will be no strain on the cables. Each barge will be equipped with a secondary battery to enable it to move independently in harbours or docks. A demonstration trip, in which only the generating boat and one barge took part, was made from New York to Oswego *via* the Hudson river and Erie canal.

Heating Rivets with Electricity.—Mr. A. S. Mill, writing to the *Electrical World*, draws attention to the economy effected by heating rivets electrically. At a price of 2.8 cents per kWh, a batch of ¾-in. rivets was heated at a cost for energy of 0.1 cent per lb. under favourable conditions. The average cost is about 0.35 cent per lb. The heater requires about 60 kW at full load, and heats up 150 ¾-in. by 3½-in. rivets in twenty minutes; a ¾-in. by 5-in. rivet can be heated in fifty seconds. Compared with the former practice, using four coal-fired heaters, which required 16 hours' attendance per week, the first cost of an electric rivet heater is more than covered in the first year's service.

The County of London Co.'s Bill.—The County of London Electric Supply Company Bill was read a third time in the House of Commons on August 10th.

Appointments Vacant.—Electrical foreman (£45 per month) for the Gold Coast, West Africa; e.h.p. and l.p. plumber-jointer, for the Wolverhampton Corporation Electricity Department; plumber-jointer, for Stepney Borough Council Electricity Department; assistant in the mains department, for the Wolverhampton Corporation Electrical Engineer's Department; junior charge engineer, for Barnsley City Council Electricity Department; instructor in oxy-acetylene and electric welding, for the Loughborough College. (See our advertisement pages to-day.)

Electrolytic Disinfecting Fluid.—The report of the Medical Officer of Health (Dr. F. W. Alexander) to the Borough of Poplar, for 1920, states that 39,255 gallons of electrolytic disinfectant were manufactured, making 78,510 gallons as broken down for distribution. The cost was for materials, £153; electrical energy, £105; total, £258. Since the installation of the plant, a period of 15 years, 576,759 gallons of fluid have been manufactured at a cost for electricity of £769, and materials £938, less than 1d. per gallon (previous to the war the cost was under ½d. per gallon, but even with the strong fluid which at present is being made and broken down, the cost is still about ½d. per gallon when the gallons are reckoned in bulk).

The Government of Greater London.—It was recently announced by Sir Alfred Mond, Minister of Health, that a Royal Commission is to be appointed to consider the question of the government of Greater London. It is considered probable that, among the main questions which will receive the Commission's attention, transport and electricity supply will be included.

Electrical Fires.—A part of the big station of the Triphasé company at Asnières, France, was destroyed by fire lately owing, it is said, to a short circuit. *L'Industrie Electrique*, however, takes exception to this too general explanation, and says it may more easily have arisen from overheating of the conductors, ignition of the oil in the transformers or circuit-breakers, or breakage of the wires in cables through electrolysis. Abuse of the term "short circuit" leads to the frightening of persons ignorant of the effects of electricity, and very often casts unmerited discredit on electric installations.

Date of the End of the War.—The Premier announced in the House of Commons on July 28th that the official date of the termination of the war, except as regards Turkey, will be September 1st next. The Defence of the Realm Regulations and other temporary laws expire at the end of the war, except such as have been continued by fresh statutes. An official date for the end of the war also affects many contracts.

Human Electromotive Force.—That a considerable deflection is produced on a sensitive high-resistance galvanometer by applying the fingers to the terminals is well known to electricians who use such instruments, and has probably been ascribed to electrolytic or thermal e.m.f.'s. But a new light is thrown on the subject by Messrs. G. G. Scott and J. Tulgan, of the College of the City of New York, in a letter to *Science* of July 29th. They say:—

"Recently, while making a nerve muscle preparation, the thigh muscles of the left leg of the frog were removed and the nerve on the same side isolated but not sectioned. The body was well moistened with physiological saline, and lay on a glass plate which was also well moistened. The toes of the left foot were held in the left hand, while forceps, held in the right hand, were accidentally placed upon the body of the frog. Immediately a violent contraction of the muscles of the left leg occurred. This was so unusual that we investigated it further. The same results were obtained repeatedly. It must be noted here that one metal was used instead of two as in Galvani's experiment, and in place of the other metal the human hand was used. The current stimulating the nerve might have been due to the difference in potential between the metal and the hand, and for that reason we substituted the right finger for the metal previously used and obtained the same results. We therefore concluded that the nerve was stimulated by the action current of the human body, the electrodes being the fingers of the right and left hands and the indicator or the galvanometer being the contractions of the frog's muscles.

"The same experiment was tried on a number of frogs and in every case we obtained the same results, although more striking in some preparations than in others. We found that by making contact with any part of the frog's body or even the saline solution on the plate the muscles contracted.

"When a non-conductor was interposed between the toes and the hand we found that no contraction took place. When a non-conductor such as wood was used for the right electrode no contraction took place."

Interlinking in California.—In order to meet pressing demands for power supply in 1920, pending the installation of additional generating plant, says Mr. F. B. Lewis, in the *Electrical World*, the companies in the northern and southern halves of the State of California were inter-connected, with marked advantage to the load curves and to the cost of working, as the hydro-electric stations were thus more fully utilised. In the southern half of the State seven systems are interlinked, covering an area of about 350 by 150 miles, with a maximum demand of 300,000 kW—which occurs, strange to say, in the forenoon during July, owing to the heavy demand of the agricultural load. The daily load factor is also greatest in the summer. Great attention has been given to consideration of the operating conditions at all periods of the year, to ensure that both the steam-driven and the hydro-electric plant shall be utilised to the best advantage.

Educational.—The report of the Standing Joint Committee of local education authorities and teachers' associations on scales of salaries for teachers in technical schools, &c., has recently been published (H.M. Stationery Office, 3d.). Among the recommendations are special additions to salaries for honours degrees or their equivalents, the latter being determined by the local authority concerned, in addition to any list which may be drawn up by the Standing Joint Committee. The report states that instructors should be skilled in trade processes or artistic crafts, and have had at least five years' commercial or industrial experience after the age of 21. Principals, head masters, and head mistresses, heads of departments and instructors are classified under six heads, but the committee recommends that standard scales should be formulated by the local education authorities. Service towards additions to salaries is detailed under six heads, and it is recommended that the scale shall take effect as from April 1st, 1921.

Institution Notes.—Institute of Metals.—The Autumn Meeting of the Institute is to be held at Birmingham from September 21st to 23rd, and a large percentage of the Institute's 1,400 members is expected to be present. Visits to a number of works in the district are being arranged, and among the papers to be read are the following:—"Experiments in the Working and Annealing of Copper," by F. Johnson, D.Sc.; "The Extrusion Defect," by R. Genders, M.B.E., B.Met.; and "The Electrolytic Etching of Metals," by F. Adcock, M.B.E., B.Sc.

All applicants for membership whose forms are in the secretary's hands before noon on September 7th will be entitled to take part in the proceedings.

I.E.E. Western Centre.—The tenth annual meeting of this Centre was held in Hereford on July 25th, when about 80 members were present. Members arrived from their various districts by motor-car, and a meeting was held in the Booth Hall, Mr. A. J. Newman presiding. The following officers were then elected for the ensuing session:—Chairman, Mr. MacWhirter; vice-chairmen, Messrs. C. T. Allan and F. Tremain. After routine business had been disposed of, Mr. Dymond, Chairman of the Hereford Electricity Committee, gave an interesting address upon the city's electricity undertaking and the rural supply system. After luncheon, various parts of this system were inspected. The party was entertained to tea by Mr. W. T. Kerr (the City Electrical Engineer) and Mrs. Kerr.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. William C. Jeary, late of the General Electric Co., Ltd., Armorduct Manufacturing Co., Ltd., Magic Appliances, Ltd., and recently manager for Great Britain for N. V. Telga, Amsterdam, is now managing director of the Jeary Electrical Co., Ltd., 8, Lambeth Hill, Queen Victoria Street, E.C., which company has been formed for the purpose of taking over the business of the late Mr. G. Braulik.

The Bolton Corporation Electricity Committee has passed a resolution of appreciation and thanks to the borough electrical engineer, Mr. W. J. H. Wood, and his staff, for their excellent and indefatigable services during the coal dispute.

Mexborough Urban Council and Mr. J. B. Feltham, the Council's electrical engineer, have compromised on the amount of arrears of salary in controversy, and the salary has been fixed at £500 a year, subject to confirmation at a further meeting of the Council.

Major F. J. Chapple, D.S.O., has succeeded Mr. E. A. Paris as general manager to the Yorkshire (Woollen District) Electric Tramways Co., Ltd. In addition to the D.S.O., he holds the French Legion of Honour and the Croix de Guerre.

Sir George Hadcock has joined the board of the Still Engine Co., Ltd.

An Australian newspaper states that Mr. George A. P. Weymouth (of Weymouth's, Ltd., Melbourne, and the English Electric Company of Australia, Ltd., Sydney), having decided to practise privately, has resigned from the boards of these companies. He will continue to act as technical adviser on all electrical engineering matters to both companies.

We regret to learn of the serious illness of Mr. W. L. Madgen, but we are glad to hear that his health is now improving.

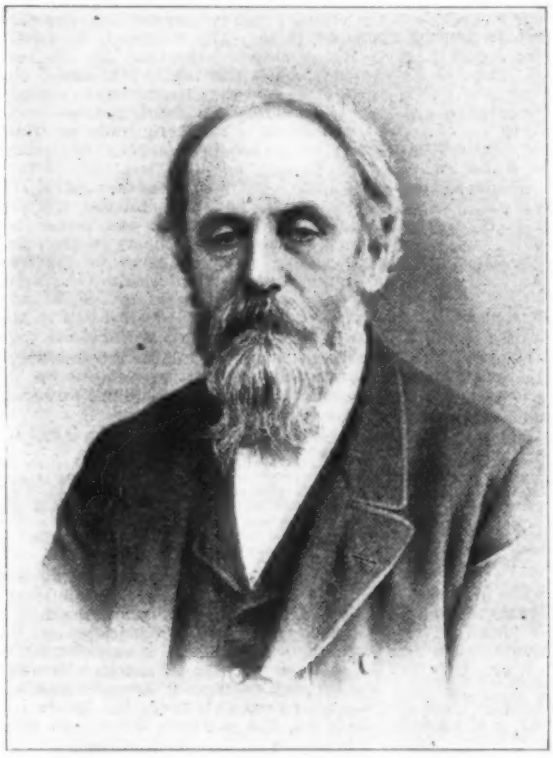
Mr. F. O'Flynn has resigned his position as electrical engineer to the Limerick Corporation.

Mr. A. L. Tester, A.M.I.E.E., who joined the firm of Messrs. Williams & Williams, Ltd., engineers and metal casement manufacturers, of Chester, towards the end of last year, has just been appointed sales manager to Mr. B. A. Williams, managing director. He will control the sales organisation from the Sardinia House office in Kingsway, W.C. 2.

Mr. H. R. Forbes Mackay, general manager of the Sydney Municipal Electricity Department, is shortly visiting this country and America to study the latest electricity supply developments. He is expected to arrive in London in October. We shall refer to the matter further next week.

Obituary.—Francis Bacon Crocker.—We regret to learn from *Nature* of the death of Prof. F. B. Crocker, who was president of the American Institute of Electrical Engineers in 1897. He was the author of various works on electrical subjects. From the American *Electrical Review* we learn that Prof. Crocker was in his 61st year; he founded the School of Electrical Engineering at Columbia University, and was head of it for nearly 20 years. In association with Dr. S. S. Wheeler and Mr. C. G. Curtis, he produced in 1886 the first commercial electric motor, and was one of the founders of the C. & C. Co. and the Crocker-Wheeler Co., of which he was a director at the time of his death. He was a keen advocate of the standardisation of electrical equipment throughout the world, and contributed very notably to the development of the electrical industry.

Samuel Alfred Varley.—By the death of Mr. S. A. Varley, A.M.Inst.C.E., on August 4th, at the age of 89, another of the few remaining links with the pioneering days of the electrical industry has been severed. Mr. Varley was one of the original members of the Society of Telegraph Engineers (now the I.E.E.). He was the third son of Cornelius Varley, and brother of Cromwell F. Varley, and he sat at the feet of Faraday himself. Scientific investigation was with him a passion, and in the employment of the Electric Telegraph Co. he found opportunities for developing his inventive faculties, his first notable achievement being the construction of an electric chronograph. During the Crimean war field telegraphs were used for the first time, and Varley was placed in charge of this new service until peace was



The late S. A. Varley.

restored. On his return to England he took a prominent part in submarine telegraph work, showing marked originality of thought, and invented important improvements in telegraph apparatus, including a polarised-needle instrument and a lightning "bridge." He also, in 1866, constructed a self-exciting dynamo (the first machine made with soft-iron magnets), and a system of electric communication between passengers, guards, and drivers on railway trains. Unfortunately, the publication of his invention of the dynamo was delayed, through no fault of his own, with the result that he did not secure the credit due to the originator of this supremely important discovery. The purchase of the telegraphs by the Government ruined a manufacturing business which Varley had built up, and he suffered from ill-health for some years, but in 1874 he became assistant manager of the British Telegraph Factory, and in 1876 he patented the first compound-wound dynamo; here again he was unfortunate in being before his time—the patent was allowed to lapse. But in 1885 and following years the question was raised in the Courts, and was fought through to the House of Lords, the decision at each stage being in favour of Varley's claim to priority. Another of his inventions was the time ball used at Greenwich and other observatories. Throughout his career he was dogged by misfortune, and never reaped the reward that was due to his epoch-making inventions. A Civil List pension was granted to him as a slight recognition of his meritorious services to the nation. Mr. Varley had been in ill-health for five years, and had been in the care of his son, the Rev. Telford Varley.

In our issue of September 9th, 1892, we published a full account of his career, with illustrations of his self-exciting and compound-wound dynamos, from which we reproduce the accompanying portrait.

The funeral took place on Tuesday last at Winchester. The service, conducted by the Rev. Telford Varley, was held at St. Paul's Church, and the remains were interred at the New Cemetery, Winchester. Among those present were a daughter of the deceased gentleman, Mr. Percival Varley (the eldest son), the Rev. Telford Varley and daughters, and Mr. E. A. Gatehouse (son of the late Mr. T. E. Gatehouse, who was a close personal friend of Mr. Varley's, and was zealous in championing his cause). The wreaths included one from the president of the Institution of Electrical Engineers on behalf of the members, and one from the chairman and directors of the Electrical Review, Ltd.

NEW COMPANIES REGISTERED.

Allenwest-Brookhirst (1921), Ltd. (175,995).—Private company. Registered July 28th. Capital, £550,000 in £1 shares. To adopt agreements with Allen West & Co., Ltd., Brook, Hirst & Co., Ltd., Electric Control, Ltd., and the Watford Electric & Manufacturing Co., Ltd., and to carry on the business of electrical and mechanical engineers and contractors, manufacturers of and dealers in electrical switchgear, control gear, engines and apparatus, brass, iron, and metal founders, &c. The subscribers (each with one share) are: W. J. Hill, 2, Bond Court, Walbrook, E.C., solicitor's clerk; J. Bennett, 45, Kildoran Road, Brixton, S.W. 2, clerk. The first directors are to be appointed by the subscribers. Qualification (except first directors who require none): £1,000. Remuneration as fixed by the company. Solicitors: Linklater & Paines, 2, Bond Court, Walbrook, E.C.

Standard Electric Sign Co., Ltd. (175,987).—Private company. Registered July 27th. Capital, £500 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are: E. A. F. Boys, 478, Archway Road, Highgate, N., clerk; Doris Wain, 65, Clyde Road, Alexandra Park, N., clerk. The first directors are not named. Qualification, 1 share. Solicitor: H. G. Thomas, 17, Streatham Place, Brixton, S.W.

Rose Bros. Electrical Co., Ltd. (175,986).—Private company. Registered July 27th. Capital, £20,000 in £1 shares. To carry on the business of manufacturers, importers, and exporters of and dealers in electrical batteries, lamps, and torches, hand, cycle, and other lamps, electrical instruments and novelties, &c. The permanent managing directors are: A. H. Rose (chairman), 25-27, Milton Street, E.C. 2; T. A. Rose, 25-27, Milton Street, E.C.2. Registered office: 25-27, Milton Street, E.C.

London Emery Works (1921), Ltd. (175,949).—Private company. Registered July 26th. Capital, £100,000 in £1 shares. To take over the London Emery Works at Park, Tottenham, N., together with the building and other estate formerly belonging to the London Emery Works Co., Ltd., and recently to R. Nuttall, and to carry on the business of manufacturers of and dealers in emery, emery and glasscloths and papers, flint, garnet, carborundum, corundum, and other abrasives, founders, engineers, machinery manufacturers, &c. The first directors are: R. Nuttall, Meadow Bank, Shuttleworth (chairman and permanent director); N. Haslam, 8, Nelson Street, Bury. The Board of Trade authorises the acquisition of the undertaking of the London Emery Works Co., Ltd., the books and documents of which have been liable to inspection under the Trading with the Enemy Act. No qualification required for first directors. Qualification of subsequent directors: 10,000 shares. Remuneration of R. Nuttall as chairman: £300 per annum. Registered office: Park, Tottenham, N. 17.

Hay Maryon Works (Stroud), Ltd. (175,943).—Private company. Registered July 26th. Capital, £1,000 in £1 shares. To carry on the business of electrical, mechanical, mining, civil, agricultural, motor, and general engineers, general engineers' sundriesmen, contractors, machinists, smiths, millwrights, electricians, brass, iron, steel, and other metal founders, manufacturers of and dealers in light castings, makers and repairers of springs for vehicles, carriage and chassis builders, &c. The first directors are: M. Hay, "Pyrford Green House," Pyrford Green, near Woking, engineer; J. F. Maryon, 75, Park Road, Ilford, engineer (both directors of Hay, Maryon & Co., Ltd.). Qualification: £10. Registered office: Lightpill, Stroud.

British & European Trading Co., Ltd. (175,913).—Private company. Registered July 25th. Capital, £100 in 2s. shares. To carry on the business of manufacturers of and dealers in electrical and other goods, appliances, articles, and novelties, general manufacturers, haulage and carting contractors, carriers and dealers in motor cars, lorries, or other vehicles, &c. The first directors are: A. A. Henley and D. W. Henley, both of Oak House, The Mount, Sydenham, S.E. Registered office: Copthall House, Copthall Avenue, E.C. 2.

Semaphore, Ltd. (175,929).—Private company. Registered July 25th. Capital, £500 in £1 shares (275 "A" and 225 "B"). To carry on the business of importers, exporters, and manufacturers of and wholesale and retail dealers in electrical apparatus of all kinds, electric batteries, machinery, motor vehicles, agricultural implements, tools, hardware, soft goods, and textile fabrics, boots and shoes, clothing, fancy goods, stationery, leather goods, furniture, china, glass, toys, grocery, confectionery, and provisions, &c. The subscribers (each with one share) are: J. Portwine, 14, Sydenham Hill, S.E. 26, motor engineer; W. Wadden, 44, Willington Road, Stockwell, S.W. 9, typist. The first directors are: J. Portwine (chairman), E. E. G. Boite, W. H. Edridge, H. M. Harris, and J. Weller. Solicitor: J. Lee Smith, 49, Finsbury Pavement, E.C.

W. J. Tough & Partners, Ltd. (175,871).—Private company. Registered July 21st. Capital, £2,000 in 1,500 10 per cent. cumulative preference shares of £1 each and 2,000 founders' shares of 1s. each. To carry on the business of electrical, mechanical, and motor engineers, &c. The permanent directors are: J. Wright (chairman and managing director), 149, Brixton Hill, S.W. 2; W. J. Tough, 29, Goulden Street, Battersea, S.W. Registered office: 32, Shaftesbury Avenue, W. 1.

Electric Locomotion & Foundry Co., Ltd. (175,895).—Private company. Registered July 23rd. Capital, £6,000 in £1 shares. To take over (1) the business of iron and brass founders and finishers, carried on by G. D. Gillender and T. Gillender at Glasshouse Lane, East Street, Gateshead, as the "Northern Brass Foundry Co.," and (2) the business of electrical and mechanical engineers carried on by R. L. Stanbrook and W. S. Mundle at Globe Chambers, The Side, Newcastle-on-Tyne, as "Stanbrook & Mundle" and "Electric Locomotion Co." The first directors are: G. L. Collins, South Dene Tower, Gateshead, Durham; R. A. Bowron, Sheriff Mount South, Gateshead, Durham; R. L. Stanbrook, 34, Till Street, Newcastle-on-Tyne; W. S. Mundle, 33, Monarch Terrace, Gateshead; G. D. Gillender, 38, Claremont Street, Gateshead; T. Gillender, 24, George Street, Pelaw, Durham (general managers and directors). Qualification: £500. Registered office: Globe Chambers, The Side, Newcastle-on-Tyne.

B. I. Staff Guild Stores, Ltd. (175,937).—Registered July 26th. Capital, £1,000 in 5s. shares. To carry on on a co-operative basis for the benefit of the members and those entitled to the privileges of members the business of storekeepers in all its branches. No person shall be eligible to become a member unless he shall be at the time when any shares are acquired by him employed on the permanent staff of British Insulated and Helsby Cables, Ltd., and over 21 years of age, or else a member of the management committee of the said company. The first directors are: J. Davidson, 10, Aspinal Street, Prescot; F. A. Dabbs, 20, Beverley Road, Liverpool; W. Pirie, 132, Warrington Road, Prescot; F. S. Phillips, Stenlands, Whiston Lane, Prescot; F. Smart, Auld House, Warrington Road, Prescot; E. Mather, 64, Beaconsfield Street, Prescot; D. W. Aldridge, Beechwood, Warrington Road, Prescot; W. G. Pender, Mayfield, Old Lane, Eccleston, near Prescot; C. E. Croston, 4, Jubilee Avenue, Broad Green, Liverpool; B. Wood, Lea Hurst, James Lane, Prescot. Minimum cash subscription: 400 shares. Qualification: One share. Secretary: W. Leiveseley. Registered office: Warrington Road, Prescot.

Norwegian Radio Co., Ltd. (1,981F).—Particulars filed July 12th. Capital, Kr. 1,000,000 in Kr. 1,000 shares. Incorporated in Norway on July 1st, 1919, to manufacture and deal in radio-stations and apparatus. British address: 50, Grainger Street, Newcastle-on-Tyne, where A. E. Salvesen is authorised to accept service. Directors: Major C. H. Bruun (chairman), C. Wisbech, H. A. J. Krag, and K. Holmvang (manager), all of Christiania.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

C. F. Elwell, Ltd.—Mortgage debenture dated June 30th, 1921, to secure £6,000, charged on company's property, present and future, including uncalled capital. Holders: Radio Communication Co., Ltd., 34-35, Norfolk Street, Strand, W.C.

Central Electric Supply Co., Ltd.—Particulars of £500,000 8 per cent. secured and guaranteed redeemable notes, authorised by resolution of March 29th, and covered by trust deed dated June 22nd, 1921; whole amount issued, charged on certain freehold land and buildings in Marylebone and company's undertaking and other assets, present and future (subject to £500,000 4 per cent. guaranteed debenture stock). Trustees: Merchants Trust, Ltd. (Registered July 23rd, pursuant to Order of Court.)

Dudley, Stourbridge & District Electric Traction Co., Ltd. (14,763).—Return dated June 8th, 1921. Capital, £300,000 in £5 shares (20,000 ordinary and 20,000 preference). All shares taken up. £200,000 paid. Mortgages and charges: £72,500.

Cuba Submarine Telegraph Co., Ltd. (4,710).—Return dated May 11th, 1921. Capital, £220,000 in £10 shares (16,000 ordinary and 6,000 preference). All shares taken up. £220,000 paid. Mortgages and charges: Nil.

Chesham Electric Light & Power Co., Ltd.—Particulars of £35,000 debentures authorised July 22nd, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Pernambuco Tramways & Power Co., Ltd.—Particulars of £500,000 debentures, authorised June 15th, and covered by trust deed dated July 15th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital and tramway, electric lighting and power and gas undertaking, and other real or immovable property in Brazil. Trustees: Hon. A. P. Henderson and Capt. C. H. Schreiber.

Hall Brothers (Manchester), Ltd.—Issue on June 30th, 1921, of £150 debentures, part of a series already registered.

Thomas Bolton & Sons, Ltd.—Third mortgage dated July 18th, 1921, to secure £150,000, charged on company's undertaking and property, present and future, including uncalled capital. Holders: R. C. Henderson and J. S. Gray, 39, Threadneedle Street, E.C.

London-Platino-Brazilian Telegraph Co., Ltd. (12,093).—Return dated May 25th, 1921. Capital, £400,000 in £10 shares. 37,480 shares taken up. £374,800 considered as paid. Mortgages and charges: Nil.

Chelsea Electricity Supply Co., Ltd. (20,468).—Return dated March 30th, 1921 (filed May 10th). Capital, £400,000 in £5 shares (74,000 ordinary and 6,000 preference). 49,436 ordinary and 6,000 preference shares taken up. £218,850 paid. £58,330 considered as paid. Mortgages and charges: £94,675.

City of Oxford Motor Services, Ltd. (91,106) (formerly City of Oxford Electric Tramways, Ltd. Renamed February 11th, 1921).—Return dated March 21st, 1921. Capital, £150,000 in £1 shares. 63,000 shares taken up. £1,007 paid. £61,993 considered as paid. Mortgages and charges: £37,500.

General Electric Co.—A memorandum of satisfaction in full on July 21st, 1921, of first mortgage debenture stock issued by the General Electric Co., Ltd., and secured by trust deed dated November 30th, 1900, securing £200,000, has been filed. There has also been registered a trust deed dated July 22nd, 1921, to secure £3,500,000 7 per cent. mortgage debenture stock, charged on Witton Works, cottages and buildings in Aston-juxta-Birmingham, the Peel Conner Telephone Works, and various other properties in Salford and Coventry; the Fraser & Chalmers Works, Erith, the Osram Works, Hammersmith, the Union Works, Wembley, Magnet House, Kingsway, and the company's undertaking and property, present and future, including uncalled capital. The trustees for the debenture stock holders are the London City & Midland Executor & Trustee Co., Ltd., 5, Threadneedle Street, E.C.

New Gutta Percha Co., Ltd. (74,517). Registered June 8th, 1921. Capital, £125,000 in 50,000 preference shares of £1 and 138,250 ordinary shares of 10s. Return dated June 8th, 1921; 14,100 preference and 138,250 ordinary shares taken up; £30,475 paid on 11,350 preference and 38,250 ordinary; £52,750 considered as paid on the remainder. Mortgages and charges: £25,000.

CITY NOTES.

Fuller's United Electric Works, Ltd.

In our last issue (p. 191) we published a brief summary of the directors' statement for the year ended March 31st, showing a loss of £129,408. We now have before us a copy of the report itself, and we are enabled to supplement the information already given by explanatory comments included in the directors' review of the year's operations. It is pointed out that the year under review was an anxious one for all industrial enterprises, and in common with many others, Fuller's experienced great difficulties in their business. The loss of £129,408 includes £6,678 loss on realisation of investments, also interest on short-term notes, £13,333, whilst in order to meet the great drop in prices the stock has been substantially written down. Until the autumn of last year large orders were being placed for the company's products, but in the latter part of August the motor trade suffered a severe set-back, which has since become more acute. The result was that contracts booked were not taken up and orders were cancelled, and the anticipated business did not materialise. The same conditions were experienced in the colliery, rubber, and other industries on which the company was dependent for orders. In consequence the company, which had made large purchases in order to meet the anticipated trade, found itself with heavy stocks at a time when business had seriously shrunk. Owing to this depression in trade, the overhead charges largely exceeded the contemplated ratio to the business effected, which, together with the depreciation in the value of stock, has adversely affected the year's trading. Important economies have been made to reduce the overhead charges to meet the present conditions of trade. The carbon factory felt the effect of unrestricted German competition, with the result that the directors decided to close this department temporarily pending the passing of the Key Industries Bill. Proposals were submitted to the meeting, held on July 28th, for reducing the capital by writing down the ordinary shares to such a figure as will almost cancel the loss shown in the accounts. This will permit future profits to be distributed in paying dividends, instead of being applied to pay back the deficit shown in the accounts. The directors and their relations hold between them over two-thirds of the ordinary shares, and the loss, therefore, will be largely borne by them. The company during the year found it necessary to obtain loans from the bankers, who now ask for security, and it was in order to enable this to be done that the directors asked the shareholders to sanction the creation and issue of debentures as mentioned last week. There are at present indications of returning trade, of which the directors have every confidence the company will obtain its share.

In the balance sheet "stock-in-trade" stands at £171,777; goodwill "as at April 1st, 1920" figures at £25,000, and preliminary expenses at £22,775. The issued and subscribed capital is £401,493 in preference and ordinary shares, and £200,000 in short term notes, 7 per cent., income tax free. The loan from the National Bank of Scotland is £71,494. Sundry creditors and credit balances appear at £68,187, and on the assets side sundry debtors and debit balances are £84,488, less £2,500 reserve for bad and doubtful debts.

The two special resolutions coming before the meeting were: (1) Sanctioning the issue of first mortgage debentures for securing an aggregate principal sum up to but not exceeding £150,000. Resolution (2) reads:—

(2) That the capital of the company be reduced from £500,000 divided into 250,000 ordinary shares of £1 each and 250,000 8 per cent. cumulative participating preference shares of £1 each, of which 151,507 ordinary shares and 250,000 preference have been issued and are fully paid up (less 14 of such preference shares which have been forfeited) to £378,794 8s., divided into 98,493 ordinary shares of £1 each, 151,507 ordinary shares of 4s. each and 250,000 cumulative participating preference shares of £1 each by writing off from each of the 151,507 present issued ordinary shares the sum of 16s. per share, which has been lost or is unrepresented by available assets.

The Marconi International Marine Communication Co., Ltd.

The twenty-first ordinary meeting was held on August 4th at the Connaught Rooms, Mr. Godfrey C. Isaacs, the deputy chairman, presiding. In proposing the adoption of the report, after referring to the absence of the chairman, Senatore Marconi, who was away from London engaged in some very important research work, Mr. Isaacs said that in the balance sheet the first mortgage debentures stood at £68,100, showing a reduction of £28,280 since the preceding year, due to favourable opportunities arising as a consequence of the depreciated value of the franc for purchasing the debentures on advantageous terms. The general reserve account and the reserve account for obsolescence of plant together represent the same figure as at the end of 1919. In the profit and loss account salaries showed an increase of some £4,500, general charges, difference in exchange and depreciation of investments showed an increase of some £39,000, all of which, with the exception of about £2,000, was due to depreciation of Government securities and to the reduced value of foreign currencies. Expenses of ship telegraph stations had very materially increased, in part due to the greater number of stations in operation at the end of 1920, as compared to 1919, but the increase which had taken place in operator's salaries was mainly responsible for the high figure of £588,693, which appeared under this heading in the accounts. On the credit side the revenue had amounted to £933,567, as compared with £772,018 for 1919. It was, of course disappointing to see a set-back in the profits, but they must not be despondent upon that account. They were going through a very bad period, which was being felt in practically every business. They had suffered perhaps far less than most. There had been a very substantial increase in all working costs, material had risen considerably, wages of every description had been raised substantially, whilst travelling expenses were more than double what they used to be. That which had affected them most, however, was the state of foreign currencies and the depreciation of Government securities; but those losses might be for the most part only temporary, and he thought they could

confidently look to their being far less extensive finally than the figure at which they had been calculated. That which was most material and upon which they could congratulate themselves, was that the business during the period showed further expansion. The number of ships' installations increased during 1920 by approximately 12 per cent., and the revenue from ships' telegrams showed even a greater appreciation. Those circumstances, together with the fact that the business this year continued to expand, had been mainly responsible for their feeling justified in recommending that part of the balance of profit of previous years should be used to maintain the dividend for the last year. Until foreign currencies became more normal the profit in sterling of their foreign business must, of course, continue to suffer, but they hoped they had seen the worst in that direction. When he last addressed them they were in the throes of a strike of wireless telegraph operators. He then explained that they were unable to make any change in the pay of their employés without the consent and approval of shipowners. On August 26th last terms of settlement were arrived at which gave a very substantial increase of salaries. Subsequently by an award of the Industrial Court, dated July 1st this year, some reduction in those rates was made consequent upon the reduction affecting the wages of other seafarers. Since the last meeting shareholders would probably have heard of a serious attempt on the part of a new wireless company to compete with them by offering to shipowners terms and conditions which were represented to be more advantageous than those furnished by their company. That competition, fanned by the word "monopoly," had met with some success in some directions. It had been explained to them that whilst shipowners had been in every way satisfied with the service which the company had furnished, they had not been altogether loth to give some support to a competing company, believing that competition was a healthy thing. That that was true generally could not be questioned, but personally he was very strongly of opinion that a business such as theirs was likely to give infinitely better results if under one control. First of all there was the efficiency of the service, which amongst other things meant "safety at sea"; efficiency was largely dependent upon discipline, and discipline was far better maintained under one control. Then there was the question of cost. For a business of that nature to be carried out in a thorough manner, which the very nature of it demanded, one required depots and responsible men in every important port throughout the world. Finally, there was the all-important question of research and invention, both very costly, but without them there would be no progress. That there should be some who did not altogether share their opinion was not unnatural, and they did not complain. They believed that their experience, their world-wide organisation, and the care which was given to the conduct of the business, would ensure their holding their own at all times. Therefore, upon merit alone they would confidently rely whenever they might be faced with competition which did not infringe their patents. They claimed that the competing company was infringing a number of their patents, and they had communicated with them accordingly, resulting in certain admissions being made and a request that they should grant them a licence. That would seem to be the equivalent to saying to them: "We could not take your business from you without using your patents; since you have knowledge of what we are doing we must discontinue unless you will give us authority to go on." One could scarcely believe that such a request was put forward with any seriousness. They were, of course, taking steps to secure the necessary injunction together with compensation for whatever damage they might have sustained. Very considerable improvement had been made in wireless installations which were being fitted on ships at sea since the war. These improvements would have been introduced during the war but for the fact that the company was required to turn out sets and install them upon ships as fast as was possible. The new designs, carrying the latest improvements, were now being installed. The range of a ship's station had been increased under normal conditions to between two and three thousand miles; and thus a ship crossing the Atlantic was now able to keep in direct communication with one or other of the two coasts during the whole voyage. Wireless telephony for use by ships had made considerable strides during the last year. There could be no doubt that wireless telephony was destined to play an important part on ships at sea. There had also been great improvements in the wireless direction finder since he last addressed them. He had told them of the substantial increase which had taken place in the pay of telegraph operators. That increase was the only increase which the shipowners had to bear in connection with wireless telegraphy. Notwithstanding the great increase in all costs, the charge for the supply of their apparatus and the services which they rendered in connection therewith had not been increased. In that respect they were perhaps one of the rare exceptions in these times. He could not think of anything else the cost of which had not considerably risen. It was in consequence of the volume of the business that they had been able to continue on the old terms. So long as they were able to maintain their position and increase the business year by year, it was the policy of the board, in spite of monopoly, to make no increase in the charge for the services on board ship which the company performed.

Sir C. J. Stewart seconded the motion, which was adopted without discussion.

Belgium.—The Société d'Electricité & Hydraulique, the well-known Belgian electrical engineering concern, of Charleroi, reports a net profit of 264,603 fr. for the financial year ending April 30th last. This is being devoted to wiping out the loss shown in the balance sheet for the preceding twelve months, and in writing down the value of the company's holding in the shares of the Société d'Eclairage Electrique de Saint Petersbourg to the extent of 162,524 fr.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—Including £740 brought forward, the accounts for 1920 show an available balance of £33,255. There is put to reserve sinking fund £4,572; the dividend on the 7 per cent. preference shares for the year requires £3,500; the dividend on the 6 per cent. preference shares for the year, £9,000; £16,183 is carried forward.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared a dividend on the preference shares at the rate of 4½ per cent. per annum, less income tax, for the half-year; also an interim dividend on the ordinary shares of 1s. per share, less income tax.

Vera Cruz Electric Light, Power & Traction Co.—A dividend of 5 per cent., less tax, is to be paid for the half-year, making 10 per cent. for the year; £15,000 is put to depreciation and reserve account; £21,981 is to be carried forward.

Northampton Electric Light & Power Co., Ltd.—Interim dividend at 3½ per cent. (8 2-5d. per share), less tax, on the B ordinary shares is announced.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Hadfields.—£1,000,000 7½ per cent. 10-year first mortgage debenture stock.

Chatham & District Light Railways Co.—Dividend at the rate of 4 per cent. per annum, less tax, on the ordinary shares for the half-year.

Liverpool Overhead Railway Co.—The directors do not see their way to declare an interim dividend on the preference or ordinary shares. The end of "control," the present state of trade, and the consequent serious loss of revenue, coupled with the enormous increase in working expenses, render it impossible to forecast the financial results for the remainder of the year.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets are feeling the effects of the high tide of holidays, but in spite of general business being as apathetic as, in August, it usually is, a variety of interesting developments serve to keep alive the financial interest of those who follow the electrical departments. The movements of prices in the markets for new issues are comforting to those who have embarked money upon the latest attractions. After the first rush of stags to sell their Shropshire, Worcestershire & Staffordshire Electric 7½ per cent. debenture stock, the price rose from ¾ discount to a premium of 10s. With the guarantee of the British Electric Traction behind the security, it does not look expensive even at 97½, which is the present price of the fully-paid scrip. General Electric Co.'s 7 per cent. debenture stock is 1 premium—as against 4 discount soon after it came out at 92½—and the 7½ per cent. Extension debenture of the Metropolitan Electric Co., issued at 95, looks quite high enough at 7½ premium. North Metropolitan Electric 7½ per cent. debenture, also offered at 95, commands a premium of 5½.

Those who subscribed to Fuller's United Electric Works short-term Notes will view with the reverse of pleasure the disastrous report issued by the company. For the year ended March 31st last, a loss of no less than £129,400 is shown, the debit being reduced to £121,300 by £8,100 brought forward from last time. The directors propose to write off 16s. per share on the issued 151,500 ordinary shares of £1 each, and to create first mortgage debentures up to £150,000. The sum of £14,000 had been set aside for excess profits duty, and this provision, ironical as it now appears, comes in usefully for writing-off experimental and development expenditure, part of the preliminary expenses, and depreciation of plant and machinery. Another company, of another class, which has passed its ordinary dividend is Vickers. The last time that proprietors of the ordinary shares received a dividend was in May, 1920. No particular surprise is felt at the present announcement, and the shares remain about 11s., the tax-free preference stiffening to 13s. 3d.

In the list of electricity supply shares, County ordinary are better at 8¾. Charing Cross keep good at 4½, but St. James' & Pall Mall are back to 6, at which price the yield on the money is 10 per cent. The various interim dividend announcements are up to anticipation, and the prophets begin to talk of the 1920 dividends being fully maintained when the tale of the present twelvemonth is completed. The manufacturing list exhibits a good tendency. Better prices are quoted for British Aluminium, Henleys, Siemens, Telegraph Constructions and General Electric preference.

The Eastern group of cable stocks and shares is stiffening, from which it would appear that investment is quietly taking the fairly heavy block of deceased account stock, which recently came to market. Prices went back so little, however,

as to imply that there was a good deal of support ready to pick up the stocks if the prices declined to tempting levels. Chili Telephones stand out again as a strong feature, and Great Northerns are a shade better, while Anglo-American preferred goes steadily ahead.

August 16th is the date upon which the arrears of dividends are to be paid on the coupons of the Mexican Light & Power, the Mexican Electric and the Pachuca companies. On the bonds of the first two named, there are eleven coupons due, and ten on Pachuca Fives. It is peculiarly hard luck that all of these should be subject to income tax at 6s. in the pound, but this is the law. Bondholders do get consolation, however, in the fact that these coupons can be sold at a substantial premium in the Stock Exchange. Some of the proprietors have been cashing the coupons at the Bank of Montreal, but a much better price is given by people who buy them for transhipment.

Marconis have been going softly, people being afraid to speculate so closely to the time of a dividend declaration that might contain a surprise—in either direction. The Telephone debate in the House of Commons brought in a few inquiries for Automatic Telephone shares. The Postmaster-General gave the system a handsome advertisement, but said that the present condition of national finances did not justify the very heavy capital expenditure that an extension of the automatic system would involve. The price of Automatic Telephones is about 10s.

No particular change has occurred in Home Railway Electric stocks, but British Columbia issues are better, and Brazilian Tractions recovered to some extent. Anglo-Argentine Second preference have gone back to 2¾, the same price as the Firsts. Engineering shares are scarcely altered. The Yorkshire Electric Power Co. has done well in the past six months, having regard to the coal strike, its net profits of £28,300 being rather less than £2,000 down. Rubber shares are entirely neglected.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price August 9, 1921.	Rise or fall.	Yield. £ s. d.
Home Electricity Companies.					
Brompton Ordinary	12	12	8	—	£10 0 2
Charing Cross Ordinary	7	8	4½	+ ½	9 8 6
do. do. do. 4½ Pref.	4½	4½	3¾	—	7 4 4
Chelsea	4	6	3½	—	9 4 8
City of London	13	14	13	+ ⅛	10 3 0
do. do. 6 per cent. Pref.	6	6	17/-		7 1 0
County of London	8	8	5¾	+ ¼	9 10 6
do. do. 6 per cent. Pref.	6	6	8½		7 7 4
Kensington Ordinary	7	9	4¾	—	10 18 4
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	9¾	—	10 18 0
Metropolitan	6	7	3⅝	—	9 13 2
do. 4½ per cent. Pref.	4½	4½	2¾	—	7 16 0
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	3½	—	10 13 2
South Metropolitan Pref.	7	7	16/3	—	8 12 6
Westminster Ordinary	10	10	5¼	—	9 5 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	24½	+½	7 3 4
do. Def.	1½	1½	17	—	8 16 6
Chile Telephone	6	6	5⅝	+ ¼	5 13 6
Cuba Sub. Ord.	7	7	7¼	—	9 6 8
Eastern Extension	10	10	16⅜	+ ¼	6 2 0
Eastern Tel. Ord.	10	10	16⅜	—	6 2 0
Globe Tel. and T. Ord.	10	10	18¾	—	5 19 5
do. do. Pref.	6	6	9½	+ ¼	6 10 0
Great Northern Tel.	22	24	23½	+ ½	10 1 0
Indo-European	10	10	80	—	6 6 8
Marconi	25	—	2⅛	—	—
Oriental Telephone Ord.	12	12	9⅛	—	*5 16 8
United R. Plate Tel.	8	8	6	—	*6 13 4
West India and Panama	Nil	Nil	6/8	—	Nil.
Western Telegraph	10	10	16½	—	*6 1 2
Home Rails.					
Central London Ord. Assented	4	4	69½	—	5 1 8
Metropolitan	1½	1½	26½	— ¼	5 12 6
do. District	Nil	Nil	18½	—	Nil
Underground Electric Ordinary	Nil	Nil	9½	+ 1/16	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	4	2	77½	—	5 3 3
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	32	—	10 0 0
do. do. 2nd Pref.	Nil	5½	25	— ½	10 0 0
do. do. 5 % Deb.	5	5	64½	—	7 15 0
Brazil Tractions	Nil	Nil	37	+2	Nil
British Columbia Elec. Ry. Pfce.	5	5	49	—	8 9 2
do. do. Preferred	5	4½	87½	—	*8 5 6
do. do. Deferred	3	6	69½	—	*10 4 6
do. do. Deb.	4½	4½	69½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	32½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	23½	—	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	Nil	17½	+	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	16	92	—	6 14 8
British Aluminium Ord.	10	10	17/6	+9d.	11 8 6
British Insulated Ord.	15	15	1½xd	—	10 0 0
Callenders	15	15	1-7	—	10 8 8
„ 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	10/6	—	—
do. do. 5 per cent. Deb.	5	5	68/-	—	7 7 1
Electric Construction	10	10	16/8	—	12 6 2
English Electric	8	8	12/8	—	13 16 6
Do. Pref.	6	6	18/-	—	6 0 0
Gen. Elec. Pref.	6½	6½	17/6	+6d.	7 13 0
do. Ord.	10	10	1xd	—	*10 0 0
Henley	15	15	1-7/16	+ 1/16	10 5 0
do. 4½ Pref.	4½	4½	8½	—	6 18 6
India-Rubber	10	—	13	—	—
Met.-Vickers Pref.	8	8	11½	—	8 16 10
Siemens Ord.	10	10	1¼	— 1/16	*8 18 3
Telegraph Con.	20	20	3-7/8	+ ½	*5 15 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, August 9th.

	CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic per lb.	8½d.	..
a	Ammoniac Sal per ton	£65	..
a	Ammonia, Muriate (large crystal) „	£58	..
a	Bisulphide of Carbon „	..	..
a	Borax „	£34	..
a	Copper Sulphate „	£31	..
a	Potash, Chlorate per lb.	6d.	..
a	„ Perchlorate „	8d.	..
a	Shellac per cwt.	£15 10s.	..
a	Sulphur, Sublimed Flowers „	£17	..
a	„ Lump „	£15	..
a	Soda, Chlorate per lb.	4d.	..
a	„ Crystals per ton	£7	..
a	Sodium Bichromate, casks per lb.	7d.	..
	METALS, &c.		
p	Babbitt's Metal Ingots per ton	£95 to £300	..
c	Brass (rolled metal 2" to 12" basis) per lb.	10¾d.	¼d. dec.
c	„ Tubes (solid drawn) „	1/1¼ to 1/1½	¼d. dec.
c	„ Wire, basis „	11¼d.	¼d. dec.
c	Copper Tubes (solid drawn) „	1/8½	¼d. dec.
c	„ Bars (best selected) per ton	£105	..
c	„ Sheet „	£105	..
c	„ Rod „	£105	..
d	„ (Electrolytic) Bars „	£75 10s.	..
d	„ „ Sheets „	£145	..
d	„ „ Wire Rods „	£91 10s.	..
d	„ „ H.C. Wire per lb.	11¼d.	..
f	Ebonite Rod „	3/6	..
f	„ Sheet „	3/-	..
n	German Silver Wire „	2/9	..
h	Gutta-percha, fine „	13/7	..
h	India-rubber, Para fine „	1/-	1d. inc.
i	Iron Pig (Cleveland Warrants) per ton	Nom.	..
i	„ Wire, galv. No. 8, P.O. qual. „	£35	..
g	Lead, English Pig „	£25	10/- inc.
g	Mercury per bot.	£10 15s. to £11	..
e	Mica (in original cases) small per lb.	3d. to 3/-	1d. to 1/- dec.
e	„ „ „ medium „	4/- to 8/-	1/- to 1/- dec.
e	„ „ „ large „	10/- to 20/- & up	..
p	Phosphor Bronze, plain castings „	1/4 to 1/9	..
p	„ „ rolled bars and rods „	2/1 to 2/6	..
p	„ „ rolled strip & sheet „	2/3 to 2/7	..
d	Silicium Bronze Wire per lb.	1/3½	..
r	Steel, Magnet, in bars „	1/8	..
n	Tin, Block (English) per ton	£161 to £162	£3 to £4 inc.
n	„ Wire, Nos. 1 to 16 per lb.	3/9	..
p	White Anti-friction Metals per ton	£68 to £285	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
p ——
r W. F. Dennis & Co.

The Engineers' Club (London).—The announcement that the Engineers' Club will open its doors on September 1st comes after a prolonged period of silence, during which those who have applied for membership have doubtless wondered what had become of the scheme which was so enthusiastically adopted at the general meeting on June 2nd. It should, however, be realised that an undertaking of this magnitude cannot be established on a sound basis in a few days or weeks; the original scheme, moreover, fell through, and the formulation of a new one was a difficult and delicate matter. We understand that the arrangements which have been successfully effected show a very marked improvement upon the former scheme, and that the delay of a couple of months has proved a fortunate circumstance.

The premises, which will be opened next month, are situated at the corner of Coventry Street and Whitcomb Street, within a few minutes' walk of Charing Cross, and easily accessible by tube railway (Piccadilly, Leicester Square, and Trafalgar Square stations), or by omnibus services passing Piccadilly Circus. They were until recently occupied by the Road Club, and after renovation will be available for all club purposes in full going order. Ample accommodation is provided, including some 76 bedrooms, and we have no doubt that the Club will very quickly become the *rendezvous* of engineers in all branches of industry. While the qualifications of applicants for membership will be strictly scrutinised, in order to ensure that the Club shall be in fact as well as in name an Engineers' Club, the definition of an engineer is broadly interpreted, including architects, chemical engineers, and metallurgists, in addition to the civil, mechanical, electrical, gas, hydraulic, and other well-recognised professions. Mr. E. Manville, M.P., is the president, and Mr. E. L. Hill (39, St. James's Street, S.W.1) honorary secretary, to whose indefatigable and enthusiastic efforts the success of the scheme is mainly due. We understand that after September 30th an entrance fee will be imposed upon all new applicants for membership. The subscription for town members is ten guineas, for country members five guineas, and for overseas members (who will not be required to pay an entrance fee) two guineas.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL MEETING.

(*Concluded from page* 198.)

The New President.

At the annual general meeting on July 22nd, Mr. S. T. Allen was unanimously elected president of the Association for the year 1921-2. Mr. Allen has been vice-president during the past year, during which he has been actively engaged in the interests of the Association, on its own Council and committees, and as its representative on other bodies, and his well-known force of character, combined with his personal popularity, ensures that his year of office will prove fruitful of results, of advantage to the Association and the electricity supply industry in general. Before he attained to his present position as chief engineer and general manager of the electricity department of the County Borough of Wolverhampton, Mr. Allen had gained a wide and varied experience in electrical engineering. His general education was acquired at Plymouth and Mannamead College, and his technical training at Cardiff University College. Afterwards he served a term of pupilage with Messrs. S. F. Walker & Co., at the Cardiff Electrical Engineering Works, where he remained for a time as draughtsman, before assuming a post of responsibility as electrical engineer in Cardiff and the adjoining district to Messrs. Gilbert & Co., of London, taking charge of all their electrical work in that quarter. Mr. Allen's next appointment was that of electrical engineer to the Ebbw Vale Steel, Iron and Coal Co., in which capacity he was engaged on the design and erection of electrical plant. He now turned his attention to public electricity supply, making his *debut* in that profession as senior charge engineer at the Plymouth Corporation Electricity Works, which led to his attaining the position of chief assistant borough electrical engineer in the same town and holding it for seven years. His first appointment as "chief" was that of city electrical engineer at Carlisle in 1908, which he held for five years, after which he was appointed to his present position.

Photo by] [*Whitlock.*

Sydney T. Allen.

In our issue of July 30th last year we published an account of the important extensions of plant which were carried out at Wolverhampton by Mr. Allen, in great part during the war, to meet the urgent demands for power in the town. Not only was the plant completely modernised and trebled in capacity—the engine room and boiler house were reorganised and practically rebuilt, and that without interrupting the supply. The cost of the extensions was only £16 a kilowatt, and the new plant effected a remarkable economy of fuel. At the same time, the undertaking itself was radically reorganised.

In addition to his normal duties, Mr. Allen took an active part in developing the local industries; as chairman of the District Joint Industrial Council for Electricity Supply, he established cordial relations between the employers and employés, and presiding over the Electrical Engineers' Committee which prepared the joint scheme for electricity supply for the North-West Midlands District, he was largely responsible for the proposals embodied therein (this scheme has just been published, and is abstracted elsewhere in this issue).

A Member of the Institution of Electrical Engineers, Mr. Allen is a past chairman of the South Midland Centre; he is also a member of the Council and of the Executive Committee of the British Electrical Development Association, and a member of the British Engineering Standards Association.

It will be seen, therefore, that the new President of the I.M.E.A. has not spared himself in the past in promoting the interests of the industry with which he is identified; and the experience and energy which he brings to his new appointment afford a guarantee that his year of office will be a successful one, and that the choice of the Association will be amply justified.

Mr. Allen, at the annual general meeting, expressed a hope that he would be able to entertain the Association at Wolverhampton next year; we trust that Fate will be kinder to him than, unfortunately, it has been to his predecessor, Major Richardson, and that by that time industry will have regained its customary activity—if so, we have no doubt that the Convention of 1922 will bear favourable comparison with any of its forerunners.

Commercial Problems in Electricity Supply.

By E. Cross, A.M.I.Mech.E., A.M.I.E.E. (*Abstract.*)

In our anxiety to attain the highest possible efficiency in the generation of power we must not lose sight of the principal object, which is to afford such supply at the lowest possible rates consistent with reliability. It is not necessarily advisable to seek to generate the maximum quantity of power per

given quantity of coal. If the reliability of the supply is prejudiced in straining to obtain the last degree of efficiency, it will prove infinitely more costly to the supply department and to the consumer in the end.

The additional capital expenditure which can be justified to effect a saving in coal consumption is given by the formula :—

$$E = \frac{\cdot 196 \times C \times L \times f}{R} \times \left\{ 1 - \frac{1}{\left(1 + \frac{R}{100}\right)^n} \right\}$$

Where E = Additional expenditure warranted per pound of coal per unit saved.

C = Cost of coal in bunkers in shillings per ton.
L = Maximum load in kilowatts.
f = Percentage average load factor over one year.
R = Rate of interest.
n = Number of years of active life.

How much capital expenditure is warranted to gain 0.3 lb. of coal per unit at 30s. per ton with a load of 10,000 kW at a load factor of 35 per cent. assuming an active life of 15 years and interest 6 per cent.?

$$E = 30 \times 10{,}000 \times 35 \times 0.019 + 0.3 = £59{,}850.$$

Dealing with the turbine room, if the heat in one pound of steam is made up of $Ht+c$ where Ht is that portion which can be converted into work and c that quantity (assumed constant) which is abstracted by the cooling water, it follows that the efficienty $Ht/(Ht+c)$ is higher the greater the value of Ht, and high steam conditions and reheating at intermediate stages, which are methods of increasing the value of Ht, will make for improved efficiency; Ht is also increased by improving the vacuum which also tends to improve the overall efficiency within limits.

The author presents in the original paper a series of diagrams to show the effect of varying certain factors (*i.e.*, gain in steam and coal consumptions by increasing the vacuum and the latter's commercial effect on cost; variation in cost for different cooling-water conditions; relative losses in transmission lines; economical distance from load at which plant can be erected for an abundant supply of water; approximate correction factor for coal consumption with fuels of different calorific value; &c.) which need careful study.

He shows that with a given temperature of cooling water, an increase in the vacuum requires a larger quantity of cooling water, and more power for driving the circulating and air pumps due to an increase in the ratio of compression. Both items become appreciable if the vacuum be improved to any appreciable extent, and regarding the true percentage saving in coal by increasing the vacuum, a point is soon reached when any further improvement in vacuum means an actual loss in coal.

If bleeding is used, the quantity of cooling water required will be less, but heating the feed water by passing out steam from one or more intermediate stages of the main turbine would reduce the saving due to increased vacuum in the same way as in the case of increased steam conditions, as less steam is condensed and $Ht/(Ht+c)$ is greater the less the value of c. Steam auxiliaries are very efficient provided the heat in the exhaust steam can be made full use of (otherwise they are wasteful); the only loss, ignoring radiation, &c., is due to the boiler plant, but as there *is* such a loss in the boiler house, it follows that the less steam generated the more efficient is the station plant. Before installing auxiliary steam plant the efficiency of which depends entirely on the efficient use of the exhaust, due regard must be given to whether or not it can be efficiently used at all loads.

The most efficient way of utilising exhaust steam for feed heating is to pass it out from the main turbine, as a greater amount of work has been obtained from each pound of steam so used than if it had passed through a small turbine or steam ejector; in fact electrical auxiliaries, including electrically driven feed pumps, show a saving over steam auxiliaries when the feed water is heated by bleeding the main turbine. Although it is stated that steam feed pumps are less efficient than those driven electrically under the conditions stated above, their use is recommended on the score of reliability. If electrically-driven pumps are used for the sake of the last degree of economy, then stand-by steam pumps should always be ready for immediate service, but it is doubtful whether the extra capital cost (with spares) of the dual system could be justified. Having decided to install steam-driven feed pumps for regular use, the exhaust steam from which is utilised to heat the feed water, the possibility of utilising, efficiently, exhaust steam from other auxiliaries is more remote, and in any case bleeding the main turbine is more efficient.

Dealing next with the effect that the capital cost of the plant has on the most economical vacuum, the author demonstrates that it does not pay to install plant to work with a very high vacuum unless the load factor is good, due to the fact that a high-vacuum turbine is more expensive than a low-vacuum turbine, while the cost of condensing plant and auxiliaries for the same temperature of water is also greatly increased.

It is not a good commercial proposition to strain at the last 1/10 in. of vacuum even if an abundant supply of cold circulating water is available, and this contention is more pronounced where artificial cooling is necessary, as the external head on the cooling water system is then comparatively high, thus reducing the economical vacuum, which is still further reduced due to the additional capital expenditure involved by the erection of coolers.

In considering the economical distance from the load at which plant can be erected for an abundant supply of cold water, the author shows that the cost of transmission per unit proves to be the least with 11,000 volts for a distance of about 4 miles at 80 per cent. load factor to about 8 miles at 10 per cent. load factor, but beyond these points 33,000 volts is the best commercial proposition. If energy had to be delivered at 6,600 volts, cables for this pressure would be cheaper than for 11,000 volts for the first mile or two, as a step-down transformer would have to be debited to the 11,000-volt transmission.

If overhead lines had been assumed instead of underground cables, it is doubtful whether there would be any great improvement. Overhead lines are cheaper to install but more costly to maintain, and as the impedance is considerable owing to the reactance voltage, the economic loading of an overhead line is less than for an underground cable. As the voltage drop is higher it has a bad effect on the regulation, and in order to keep this in the neighbourhood of that for underground cables the line voltage must be increased to reduce the percentage drop, the actual drop being practically constant.

The conclusion arrived at from the foregoing reasoning is that with the more recent practice of cutting down the losses in the latent heat as a percentage, by adopting high steam conditions, the gain due to high vacuum is relatively of less importance than when lower steam conditions were the order of the day. Therefore, the actual saving in improvement of vacuum is not so great as to warrant the cost of annual capital charges, maintenance, and losses on long transmission lines. The difference in efficiency of, say, a 100,000 and a 200,000-kW station is small, working under like conditions, and if the load from the latter has to be distributed over a large area it might prove to be more economical to erect two 100,000-kW stations in suitable positions instead.

Never was it more necessary to take the " long view " before embarking upon schemes of great magnitude.

Buying at the present high prices and borrowing at such high rates of interest will for the time being have a serious effect on the annual capital cost per unit delivered to the consumer. The industry cannot stand still, but extensions should only be made to meet the demands as they arise and not to forestall the requirements for long periods in advance. We must not overlook the effect in the future of carrying out a large scheme under present financial disabilities in order to obtain 20 per cent. efficiency if, in the near future, Dr. Ferranti's prophecy at Ilkley last year is realised, and capital costs have fallen to figures approaching pre-war prices.

In busy industrial districts capital stations of 100,000 to 150,000 kW capacity will be found advisable, and present-day experience does not indicate that any commercial advantage could be obtained in housing a greater capacity of plant under one roof. The capacity of the roads for laying underground cables is also limited. Many small stations have been erected at pre-war cost, and as much of the capital debt has been repaid their continued existence would be justified in some instances both for stand-by purposes and for dealing with " peaks."

An important saving in capital cost can be made by retaining for a time the plant in the smaller stations as spares.

In a capital station in some cases it has been deemed necessary to allow up to 50 per cent. spare on the working capacity of the plant; provided the sum total of the capacity of the smaller stations amounted to at least a single large unit there would not be the necessity for providing more than one large spare plant at the capital station. Even if we were starting *de novo* in the erection of capital stations in suitable positions it would be advisable to provide stand-by stations at suitable strategic points to deal with emergencies. Many advantages would be derived from the use of oil as fuel at the stand-by stations instead of coal, even at a higher cost.

In conclusion, the author asks: Why should not the ordinary factory operate during more than one shift, as is the case in the heavy steel trades, collieries, and power stations? Such a rearrangement would accelerate production and very materially decrease cost.

In some instances it has been found commercially feasible to install rotary-converter sub-stations at the centres of gravity of important blocks of local load, but even in these cases the combined capital and running costs take a serious toll of the receipts. The perfecting of a reliable automatic apparatus would lead to its adoption where rotary sub-stations have already been installed, but where it is found necessary to extend a more satisfactory solution of the problem would seem to be forthcoming in the shape of the mercury arc rectifier.

Are we satisfied that we shall always obtain energy for the purpose of the generation of electricity by the medium of steam? The advent of the gas turbine would necessitate a revision of future schemes, and it would be unwise to assume that such an eventuality is so remote as to be unworthy of some attention. Moreover, it is claimed that the mercury-steam combination with 35 lb. pressure in the mercury vapour boiler will give about 52 per cent more output per lb. of fuel than a steam turbine generating plant using 200 lb. per sq. in. gauge steam pressure.

Discussion.

Mr. C. M. Shaw (Worcester), referring to a diagram, said that some years ago he made similar calculations, and arrived at an economical distance of 2¼ miles, with cooling water at 50 deg. F., not 4¼ miles as given by Mr. Cross. They were talking about big generating stations nowadays using dirty water for condensing, which led to a falling vacuum; with cooling towers the tubes kept clean, and the vacuum was maintained. With regard to a case discussed in the paper, in which the effect of using the short available supply of water at 65 deg. F. and supplementing it with water from cooling towers at 75 deg. was shown, he pointed out that if the towers were designed for 75 deg. at full load, the average temperature would be much lower. Alternative "B" (running with half the amount of water that was desirable) would result in a very unsatisfactory vacuum.

Mr. S. E. Fedden (Sheffield) congratulated the author on the excellence of his paper, and on having installed the largest generating set in this country. Referring to the consideration that was being given to the use of high pressures nowadays, to effect a very small gain in economy, he said they must consider the whole of the plant, and be very careful before embarking on the use of high-pressures in respect of the increased capital cost, maintenance, and repairs. He questioned whether much benefit would be gained in that direction. With regard to the auxiliaries, he had found the advantage of having a proportion driven by steam, to prevent a complete shut-down. Most of his pumps were electrically driven, but a steam pump kept running in reserve was well worth having. Old plant should be retained for peak loads, even if it were inefficient, in view of the high prices now obtaining. The author had referred to the reheating of steam at convenient stages; the consensus of opinion was to the effect that nothing was to be gained by reheating—the small saving was swallowed up by the large capital cost. The use of steam abstracted from the steam turbine for heating feed-water was also mentioned; he had never been able to understand how, if heat were allowed to escape with the flue gases at the steam generator itself, the loss could be made good at a later stage. He had used air heaters, but had found it difficult to utilise the heated air. While the author assumed a life of 20 years for the station plant, he had found it profitable to scrap turbines at 15 years, bringing down the steam consumption from 16 to 12 lb. per kWh, without altering the condenser. Twelve years was taken by the author as the life of the cooling towers, but the speaker had some 20 years old, which showed no sign of decay. The Local Government Board allowed only five years' life. With regard to the proposal to run with a reduced vacuum, this meant using more steam, more boilers, and more coal. He believed in generating at 11,000 volts without step-up transformers; the generators gave no trouble. He also transformed direct from 11,000 volts to 200 or 250 volts in one step. With a normal load factor, the traditional allowance of 1,000 volts per mile of transmission line was fairly near the mark. If they had sufficient boilers, there was no need to use high-class coal. He did not care to concentrate more than 100,000 or 120,000 kW at one spot, owing to the immense quantities of coal, ash, and water to be handled, and the difficulty of getting the energy away from the station. He thought that 15,000-kW sets were large enough, and actually less costly in operation than bigger ones. The efficiency of a 10,000-kW set was practically as good as that of the big sets, and the cost was not much greater. The small sets, also, were more easily put on load. Large gas-engine stations would require enormous quantities of cooling water. At Neasden, where cooling towers had to be used with water from wells, the costs were excellent; at Stonebridge Park, under similar conditions, the plant could be extended to 100,000 kW. He held that the generating plant should be kept near the load; 13 years ago he recommended this course, and all later experience confirmed this.

Ald. Winter (Rotherham) claimed that Mr. Cross was the best electricity engineer in the world! As chairman of the Electricity Committee, he always did what the engineer advised him to do—that was the sort of chairman such undertakings should have. (Applause.)

Mr. C. W. Charlesworth (Wolverhampton) dealt with the capital expenditure that was justified in order to effect economy of fuel, and pointed out that the particular method of repayment of loans that was adopted must be taken into account. There were four systems, and Mr. Cross's formula only related to one of them; the example he gave agreed with the "terminable annuity" system, but another method would result in a deficit of £500. Buying and borrowing at the present high rates would affect the annual costs not only for the time being, as the author stated, but throughout the whole future of the undertaking. The position was reflected in the recent prospectus of the Shropshire, Worcestershire and Staffordshire Electric Supply Co., which was raising capital at 7½ per cent. over a period of ten years.

A long communication from Mr. A. C. Pain related to the utilisation of exhaust steam and the recovery of waste heat from coke ovens, &c.

Mr. W. M. Selvey said that electrical engineers were not always good at propaganda—they let the business come to them. In this connection, the Coal Conservation reports were an excellent form of propaganda; they showed that electricity was now *the* motive power. A great demand for power was being experienced which had been held back for a few years by the financial stringency. Mr. Cross had made it clear that the advocacy of the super-station was somewhat overdone; calculations made with the data available to-day showed that they must move with very great caution in putting a large station at a considerable distance from its load. Mr. Fedden and he had concluded that a station of 100,000 kW with a coal load factor of 50 per cent. might be put ten miles from the load, where Mr. Cross arrived at 4¼ miles. He was glad that they were returning from wide and hasty generalisations to the detailed study of concrete cases, and he congratulated the Association on securing this very excellent paper. With regard to the economy due to a high vacuum, he drew attention to the Callendar theory of super-cooling, and said it was not purely a question of moisture content. He advocated the installation of steam-driven pumps as a stand-by to electric pumps, and said that 45 ft. was sufficient head for cooling towers. If the gas turbine were to be a success, they would have to have a new cycle; the efficiency of the present cycle was less than that of steam.

Mr. W. H. Patchell pointed out that the size of the station affected the choice of size of generating set; he had seen plans for power stations in the United States to contain six or seven 30,000-kW sets, which were not too big for such stations. In the Detroit district feeder networks were in use at 40,000 and 20,000 volts, overhead. For low pressures he certainly would use underground cables, but for high-pressures overhead mains were far away the best. In Wales he had put down both overhead and underground mains for 6,000 volts, and preferred the latter. Mr. W. T. Kerr and Mr. Napier Prentice had done splendid pioneering work with overhead mains, for which wide facilities should be given. In the case of gas engines, the cooling water was a very serious question; it must not be allowed to deposit scale in the gas-engine jackets, hence much more water was needed than might be supposed. There was a great deal of useful information in the paper.

The President, Major Richardson, referred to the Knapsack station in the Rhine Valley, of 195,000 kW, which had been put up near the lignite beds, though this necessitated the use of cooling towers, in preference to a site near ample water supplies, 10 km. farther away.

Mr. Cross, replying on the discussion, said that prices were quite different now to what they were a few years ago. If only half the normal quantity of water were available, he was convinced that it was quite good practice to use a large condenser, or mix part of the outgoing water with the incoming water and get an average result. He believed in feed-water heating, and would give data when the tests were completed. Depreciation was not alone to be considered—obsolescence came in; the old plant at Rotherham was in good condition, but obsolete for its purpose, owing to its lower efficiency. Cooling towers which were kept constantly on load, and always moist, would last a long time. He thought it was better to run on a reduced vacuum for a month or two than to put up costly cooling towers. At Rotherham he had adopted big sets right away, to avoid the usual "steps and stairs"; a single one of his consumers took half the output of a 30,000-kW set. The generating plant cost £14 a kilowatt, and the whole installation, including the buildings, £32 per kW. The gas turbine was a symbol of what *might* happen; in view of the possibilities, they had better not lay long mains. It would be a serious matter if private consumers got another means of motive power. In South Yorkshire it was not feasible to run overhead mains on a large scale.

Annual General Meeting.

The twenty-sixth annual report of the Council was submitted and adopted at the annual general meeting which was held on July 22nd, when Mr. S. T. Allen (Wolverhampton) was elected president and Mr. A. S. Blackman (Sunderland) vice-president. Mr. Allen said he hoped to entertain the Association next year at Wolverhampton. The hon. secretary (Mr. A. C. Cramb, Croydon), the hon. solicitor (Mr. P. M. Heath, Manchester), and the hon. treasurer (Mr. H. Faraday Proctor, Bristol) were all re-elected, and the ballot showed the additions to the Council to be as follows: Engineers of large towns: Messrs. S. E. Fedden (Sheffield), P. P. Wheelwright (Blackburn) and G. Tough (Coventry). Engineer of small town: Mr. R. W. L. Phillips. Committee representatives: Councillors E. C. Ransom (Ipswich) and E. P. Dymond (Hereford).

Owing to the issue of a monthly report, with the primary object of keeping members in closer touch with the Council, the report for 1920-21 was less voluminous than in previous years; it showed that five members resigned and the membership of three lapsed, but eight new members were elected, the balance for the year therefore remained unchanged. The membership now includes the committees and chief engineers of 204 undertakings, and there are, in addition, 15 associates. There are eight standing committees (some information concerning each of which is given in the report) among which the bulk of the Association's work is divided. The accounts show a satisfactory balance of £372 for the year.

During the discussion on the report Mr. S. E. Fedden (Sheffield) objected to the B.E.A.M.A. and I.M.E.A. Joint Com-

mittee's proposal to discontinue the price contract adjustment clause and to substitute for it the fixed date and penalty clause (Clause 31 of the I.E.E. conditions) now that prices were falling, because when they were on the increase manufacturers had refused to supply at a fixed price.

Mr. F. W. Purse (West Ham), while supporting the previous speaker, explained that the manufacturers' contention was that, as the material had to be purchased when the order was given, there was little probability of a reduction being made, even if the prices fell between the dates of placing the contract and delivery. The manufacturers refused to consider the suggestion that the purchaser should inspect the books in the price adjustment clause case; however, that clause was still in force, as the matter had not yet been settled.

The Secretary (Mr. A. C. Cramb, Croydon) said that the I.M.E.A. desired a penalty clause so as to be able to influence manufacturers regarding delivery.

The President (Major H. Richardson, Dundee) was firmly in favour of a fixed contract.

Mr. N. Staniland (Hornsey) was of the opinion that so long as a combination of manufacturers existed, they would be at a disadvantage whether they had a fixed price or sliding scale; sooner or later the I.M.E.A. would have to fight the B.E.A.M.A. He had been told that the manufacturer could make a profit by selling a certain article at a third of its price, but the B.E.A.M.A. forbade its members to supply at that price.

Mr. S. T. Allen (Wolverhampton), in answer to Mr. J. K. Brydges (Eastbourne), announced that no arrangement had yet been come to with the G.P.O. with regard to marking its conduit. The G.P.O. contended that it would be difficult to do so because the conduit used by electricity undertakings was initially made for, but rejected by, the G.P.O.

Mr. J. K. Brydges (Eastbourne) also complained about the attitude of the British manufacturer of heating and cooking apparatus with regard to the cost of replacement and time taken to make repairs, to the annoyance of users. The Secretary asked for information on this subject which he promised to forward to the E.D.A. to be dealt with.

Mr. H. R. Burnett (Barrow) moved a resolution, which was carried, requesting the Council to consider the desirability of arranging for the expenses incurred by members of the Council in attending Council meetings to be defrayed by the whole of the undertakings in the Association.

Councillor Hill (Willesden) moved a vote of condolence (which was passed) with the relatives of the late Ald. Vaughan, of Maidstone, and with the Maidstone Electricity Committee, and the meeting concluded with the chairman's announcement that the Association's premium had been awarded to Messrs. C. W. Charlesworth (Wolverhampton) and W. M. Miles (Sheffield) for the papers they had read during the meeting.

THE ENGINEERING CONFERENCE, 1921.

(*Continued from page* 195.)

Steam versus Electric Winding.

By W. C. Mountain. (*Abstract.*)

If the collieries are so isolated that a supply of electricity cannot be obtained from a public power station, and the collieries are of large capacity, such as those in Yorkshire, Nottinghamshire, South Wales, and to some extent in Lancashire, the most economical method to adopt is to install steam winding engines and to utilise the exhaust steam in mixed-pressure turbo-generators.

If the collieries are of moderate size, or are small, and there are several of them under one or more ownerships, it is probable that electric winding can be economically adopted, particularly if power can be obtained from a power company at a reasonable cost, but even under these circumstances the type of winder to be adopted must be carefully considered, because unless the power company has a large capacity it may be necessary to adopt electric winders with ligner balancers, as small direct-driven or geared winders, with three-phase motors with rheostatic control, may throw a peak load on the power station which will cause serious trouble.

There are also collieries where blast-furnace or coke-oven gas could be used either in gas engines or under boilers, and there is no doubt that in simplicity and first cost the use of steam turbines, with water-tube boilers using gas as fuel and properly arranged for superheaters, has advantages, and that a very high degree of economy can be obtained.

On the other hand, circumstances may make it possible to utilise the gas direct in gas engines, but it all comes to a question of cost and efficiency in running, also freedom from stoppages due to breakdowns or repairs that may be necessary in daily working.

In heavy winding in collieries in Derbyshire, which may be taken as typical of the heavy duty in this country, the exhaust steam from the winding engines is used in mixed-pressure turbo-generators and in 1918 the costs per unit delivered to the busbars in the power station were as follows:—

	Labour and stores.	15 per cent. in interest and depreciation on capital.	Total cost.
	Per kW	Per kW	Per kW
	d.	*d.*	*d.*
Exhaust steam only ...	0.0189	0.06	0.0789
Mixed pressure steam ...	0.0902	0.06	0.1502
High pressure steam ...	0.227	0.06	0.287

In the case of the high-pressure steam the coal to the boilers was taken at 7s. per ton.

Up-to-date modern steam winders are economical as regards the consumption of steam per shaft h.p., and it must be remembered that in utilising exhaust steam turbines a kilowatt can be obtained for about 35 lb. of exhaust steam at 16 lb. pressure absolute delivered from the winding engines into the turbines.

Electric winding has made very substantial progress and a great deal of heavy work of this description has been done in South Africa. The winders are fitted with semi-conical or parallel drums in accordance with the requirements, and the motors are rated to give from 1,450 to 1,600 h.p. normally, but are capable of carrying a peak load of from 3,000 to 4,000 h.p. Electric winding has also been successfully applied to mines in South Wales, the North of England, and elsewhere.

(*a*) For small collieries there is a future for electric winding if the coal used under the boilers is of any considerable value.

(*b*) In large collieries there is a future for electric winding if the cost of coal used exceeds 8s. to 10s. per ton, but this, of course, depends entirely upon the relative costs of steam winders with their boilers compared with the electrical equipment.

(*c*) Electric winding cannot be economically applied to collieries for very large outputs where it is necessary to install a generating plant to produce the necessary output for operating the winder, because the h.p. required for winding is so greatly in excess of that required for driving other machinery, and as it would be necessary to provide a stand-by plant, the costs would be prohibitive.

(*d*) In collieries generally, particularly those in which electric winding is adopted, colliery owners would be well advised to take their power from the supply companies, assuming they can purchase it at a reasonable price, even if this price is slightly in excess of the cost at which they can produce energy themselves, due to the amount of capital required for the generating plant being so heavy. The same capital expenditure could be applied to much greater advantage in increasing the electrical plant on the surface and underground.

Discussion.

In opening the discussion, Mr. M. Deacon expressed the opinion that putting down new boilers to generate electricity for winding engines was not economical, as good winding engines were so economical of steam, and electrical winding plant cost at least three times as much as steam-winding plant. Unless power could be purchased from a power station in the district the total electrification of a colliery plant was not an economical proposition, but where two or three collieries were so situated as to enable them to use a combined plant, the position was must better. If situated near blast furnaces or coke ovens, then a cheap source of power was available, and electric winding then became more feasible. A vast field still remained open for the utilisation of this waste heat in this country, and the lay-out of the sixteen contemplated large areas of electrical supply should provide for the utmost employment of these coke oven and blast furnace gases.

Mr. Luck asked whether, seeing that the winding engines only worked part of the time, it would be possible for a colliery to generate electricity during its slack time and supply it to the power company, or for public purposes. To this, in the absence of the author, and at the chairman's request, Mr. Deacon replied that there was no surplus electricity available at a colliery. Energy not required for winding was used for lighting, &c.

Mr. Thompson called attention to the fact that the system of generating electricity from waste heat was now being extensively used in Yorkshire.

The Utilisation of Exhaust Steam in Turbines.

By M. Deacon, M.Inst.C.E. (*Abstract.*)

An enormous development of the use of exhaust and mixed pressure steam turbines has taken place, particularly at collieries, where the volume of exhaust steam is necessarily large in relation to the h.p. developed, and hundreds of collieries in the United Kingdom are now performing the bulk, and, in many cases, the whole, of the underground pumping, hauling, and electric lighting, through the medium of mixed-pressure turbines. A colliery of average depth (say, 500 yds.)

and raising from 2,000 to 3,000 tons of coal per day, will produce enough exhaust steam to develop at least 1,000 h.p., and with the assistance of h.p. steam when the supply of exhaust steam is insufficient, from 1,500 to 2,000 electrical h.p. may be produced through the medium of turbines and electric generators. Assuming there are 500 such collieries in the kingdom fully equipped with turbines, the total economy in fuel amounts to 2,000,000 tons or more per annum.

In a mixed-pressure turbine plant at one of the collieries under the author's control the exhaust steam is conveyed from No. 1 winding engines and the fan engines to a receiver, and thence to an accumulator, the exhaust steam from the No. 2 winding engines being taken direct to the accumulator, from which it is conveyed to the turbines, which are direct coupled to the generators running at a speed of 3,000 r.p.m.

The pressure of the exhaust steam generally given off from a winding or fan engine varies from 2 to 3 lb. per sq. in. above the atmospheric pressure, which represents the pressure in the accumulator when not regenerating and, together with a vacuum of from 27 to 28 in., produces the required energy.

The exhaust steam from several engines may be introduced into the accumulator, and owing to the intermittent operation of winding engines, the more constant-running engines there are which can contribute a constant supply of steam the better, in order that, if the winding engine is stopped for several minutes as is sometimes necessary, the period of stoppage is bridged over by the evaporation of the water in the accumulator.

The cost of generating electrical power by exhaust steam is naturally very low, having regard to the fact that the steam would otherwise be wasted. Disregarding the exhaust steam as of any value, the cost of running is confined to labour, repairs, stores, and interest on capital and depreciation of plant. Taking the two latter at 20 per cent. on the capital outlay the cost of production per kWh *with exhaust steam only* is approximately 0.20d., and with *mixed-pressure* consisting of 20 per cent. of h.p. steam 0.40d. These costs are based upon plant at collieries controlled by the author, and are taken upon the present-day values of plant, wages, and stores, and with small coal at 20s. per ton with the plant running ten hours per day. On 20 hours per day instead of ten, on approximately full load, the cost per kWh would have been 0.10d. for *exhaust steam*, and 0.20d. for *mixed-pressure steam*. Prior to the war the cost was rather less than half the present-day cost.

The following tables show the approximate steam consumptions, including all losses in the turbine and generator, for 1,500, 2,000, and 3,000-kW turbines, with h.p. and with exhaust steam:—

HIGH PRESSURE STEAM.

Pressure 175 lb. per sq. in. Superheat 150 deg. F.
Vacuum 28½ in.

	1,500 kW. Lb. per kWh.	2,000 kW. Lb. per kWh.	3,000 kW. Lb. per kWh.
Full load	13.50	13.10	12.68
Three-quarter load ...	13.85	13.55	13.08
Half load	14.75	14.50	13.88

EXHAUST STEAM (Mixed-pressure set).

	1,500 kW. Lb. per kWh.	2,000 kW. Lb. per kWh.
Full load	29.25	28.95
Three-quarter load ...	30.20	29.85
Half load	32.75	32.40

DISCUSSION.

In opening the discussion on Mr. Deacon's paper, the CHAIRMAN remarked that the very large amount of energy realisable from low-pressure steam was not yet fully appreciated. Dealing with the economic advantages of low-pressure turbines for generating electricity, Mr. MACLAY mentioned a case where it was more economical to reduce the boiler pressure from 65 lb. to 15 lb. and put in exhaust-steam turbines in place of the high-pressure sets. The speaker strongly favoured the use of surface-condensing plant as against the jet type.

Mr. E. S. WOOD instanced an old pit, established in 1735, where he had scrapped 24 underground boilers and replaced the whole power system with electrical plant. He also used exhaust steam for driving air compressors.

In replying to the discussion, Mr. DEACON stated, *inter alia*, that he did not consider complete electrification of a large colliery the most economical method to pursue. With heavy winding a steam engine was under better control. In the plant described in the paper, very little high-pressure steam was used, and this was automatically controlled by a governor.

Damage to Tires and Rails caused by Brakes or Slipping Wheels.

BY C. P. SANDBERG, C.B.E., M.INST.C.E. *(Abstract.)*

Investigation into the mutual action between steel or iron brake shoes and the wheels or rails to which they are applied, indicates that the energy absorbed by the brakes is immediately converted into heat, and if the surface temperature attained exceeds the lower limit of the critical range of the material, then in any ferrous material containing over, say, 0.3 per cent. carbon, very definite structural changes will occur. If the thickness of the heated layer is small in comparison with the whole mass, then directly the heating effect ceases, the surface will be very rapidly cooled by conduction, and the metal will be left in the hard or martensitic state.

In addition to the thermal formation of a hardened skin the following action may also take place: Sliding of one surface over the other proceeds to a point at which both surfaces have become so heated that they are soft and plastic and tend to seize together at numerous points of contact. Whilst so united the surface layers are dragged bodily forward forming an overlap in advance of each area of adhesion and a tear behind it. The adhesion is only momentary, and the surfaces are quickly dragged apart, and recommence to slip over one another until sufficient rise of temperature and softening have occurred to cause another seizing. This alternating action of seize and slip probably occurs many times per second during the application of the brakes, and gives rise to the jarring or squeaking noises which accompany such applications, the period of the sound vibration evidently bearing a relation to the periods of slip and seize of the brakes.

The result is to produce a series of surface tears or cracks upon both brake block and the wheel or rail, the cracks running in a direction at right angles to that of the motion, and forming at regularly spaced intervals, evidently bearing a relation to the periods of seize and slip. Numerous examples of such cracks have been found upon wheel tires, and even in a more marked degree upon tramway rails acted upon by powerful (magnetic) track brakes. Corresponding cracks are also found upon brake blocks; the spacing and also the depth of the cracks appear to be greater upon the brake blocks than upon the tires or rails.

With a steel tire, which is firmly shrunk upon a rigid wheel centre, or a tramway rail which is supported throughout the whole of its length, there would appear to be no tendency for the surface cracks to spead downwards to any appreciable depth. The existence of such cracks upon a tire or a tramway rail is thus without any measurable effect upon the liability to fracture, and the chief point to be considered is that the cracks are evidence of very excessive wear, since, owing to the manner in which they are formed, portions of both surfaces must at the same time be wiped bodily away. This wear is additional to that due to ordinary rolling abrasion common to electric traction and the total wear may be two or three times greater than is the case under normal running

The results of wheel braking may be directly responsible for damage to rails when the brakes are applied with such violence as to lock the wheel and to transfer the sliding motion from between brake block and tire to between tire and rail. In addition, driving wheels frequently slip when starting and direct evidence has been obtained that from one, or from both, of these causes (*i.e.*, skidding or slipping) surface damage may be done to a sound rail which may lead to its ultimate failure in the road. The surface cracking of a railway rail is essentially more serious than that of a tire or a tramway rail, since it is only supported at intervals along its length, and is bent to an appreciable extent each time it is loaded. Under such conditions there is a definite tendency for a surface crack gradually to spread downwards until the section is sufficiently weakened to fail suddenly and completely under a normal working load.

References to rail damage caused by skidding or slipping wheels have been included in several recent American publications, and the investigations have ascribed the formation of the cracks to the failure of the hard and brittle martensitic skin under subsequent wheel loads. According, however to the views outlined above, the author's investigations point rather to the fact that the cracks are actually formed momentarily in advance of the martensite, and that their subsequent formation is doubtful or at least of minor importance.

Since occasional slipping or skidding cannot be avoided there is no sovereign remedy against rail failures of this descripton. The original surface damage is, however, clearly visible upon the rail tread, and could be observed during routine rail inspection. Any rail showing either a hardened surface or, still more important, signs of transverse cracks, should be treated with suspicion.

(To be continued.)

An Electrically-propelled Battleship.—According to the *Scientific American*, the U.S.S. *Maryland* will be ready to carry out her official trials early in November. The *Maryland* is a "super-Dreadnought" of 32,600 tons displacement, is 624 ft. long, 97.5 ft. in beam, and has a draught of 30.5 ft. The drive and equipment is wholly electrical. The motive power is provided by two 11,000-kW steam turbo-generators, running at 2,090 r.p.m. These supply power to four 7,000-h.p. induction motors which are 12 ft. in overall diameter and revolve at 170 r.p.m., the propellers being directly connected to them. Power for auxiliaries and general purposes is generated by six 300-kW turbo-generators. Oil fuel is to be used in all the boilers. The building programme of the United States Navy includes a number of electrically-propelled vessels, including three more battleships of the *Maryland* type, six 43,000-ton battleships, and six battle cruisers. The production of several of these is now proceeding under the direction of Mr. W. L. R. Emmet, who was instrumental in obtaining the adoption of the electric drive for battleships.

JOINT ELECTRICITY AUTHORITIES.

The North Lancashire and South Cumberland Scheme.

THE following is an abstract of a scheme for the constitution of a Joint Electricity Authority for the provisionally delimited North Lancashire and South Cumberland Electricity District * that has been submitted to the Electricity Commissioners by the Provisional Joint Committee for the district, the chairman of which is Mr. P. J. Hibbert and the secretary Mr. H. R. Burnett, chief engineer of the Barrow-in-Furness Corporation electricity undertaking.

It is proposed that the "North Lancashire, Westmorland, and South Cumberland Joint Electricity Authority" shall consist of 30 members, eight of whom are to be appointed by the authorised undertakers in the district—namely, three by the Barrow Corporation, two by the Lancaster Corporation, and one each by the Kendal and Morecambe Corporations and the Windermere Electricity Supply Co., Ltd.; one jointly by the County Councils of Lancashire,† Cumberland,† and Westmorland†; one each by the Urban District Councils of Millom, Dalton, Ulverston, and Grange (in the west), and Carnforth, Heysham, Ambleside, Grasmere, Kirby Lonsdale, and Windermere (in the east); one each by the rural district councils of Bootle and Ulverston (in the west), and Lancaster, Tunesdale, and South Westmorland (in the east); one by the Furness Railway Co., and one jointly by the London & North-Western† and Midland† Railway Co.'s; three by large consumers in the west, and one by large consumers in the east of the district.

The voting power will be in respect of: (*a*) rateable value applicable only to local authorities (other than county councils) represented on the Joint Authority—one vote per £50,000; (*b*) capital invested in the Joint Authority—one vote for each £10,000; (*c*) and kWh sold or purchased in the district from a public supply undertaking—one vote for the first 500,000 kWh and one vote for each additional million kWh per annum.

All money required for the provision by the Joint Authority of generating stations or main transmission lines in the district, shall be raised by the Joint Authority, but that required in connection with the distribution of electricity within the area of any local authority represented on the Joint Authority (other than a County Council) shall, unless the Joint Authority otherwise determine, be raised and lent by the local authority for that area to the Joint Authority.

The Joint Authority shall in each financial year estimate its probable revenue and expenditure (other than capital expenditure), and if it appears that there will be a deficiency in the net revenue of the undertaking the Joint Authority shall, after deducting any amount which should be provided out of the reserve fund of the Joint Authority, apportion 25 per cent. of the deficiency between the local authorities (other than County Councils) represented on the Joint Authority in proportion to the rateable values of the districts of such local authorities; 25 per cent. in proportion to the number of inhabitants in the respective districts of such local authorities as appearing in the last published census return in existence at the time when the Joint Authority apportions the deficiency; and the remaining 50 per cent. in proportion to the number of units of electricity consumed in each of the respective districts.

The Joint Authority shall apportion the net surplus revenue of the undertaking remaining in any year (after making the payment provided for in "revenue account," and the annual proceeds of the reserve fund) among the local authorities represented on the Joint Authority in the same proportions as deficiencies are chargeable to such local authorities, and the sums so paid shall be carried to the credit of the respective district funds, and general district rates of their respective areas.

Provided always that if such net surplus revenue in any year exceeds £5 per centum per annum upon the aggregate capital expenditure for the time being on the undertaking, the Joint Authority shall make such a rateable reduction in the charges for the supplies of electricity as will secure that in the next succeeding year the net surplus revenue shall not exceed the said percentage on such aggregate capital.

The Joint Authority shall enter into agreements whereby the whole of the generating plant (but not necessarily the buildings) of the five authorised undertakers in the district shall be transferred to the Joint Authority. The agreements may provide for the working of the plant by the undertakers on behalf of the Joint Authority until such time as the Joint Authority is in a position to shut down the plant and provide a supply from another source.

To obviate the necessity for any immediate large expenditure upon a capital station, it is proposed that the existing Buccleuch Street works of the Barrow Corporation should continue to be employed, and that a hydro-electric station should be constructed at Backbarrow which would together generate a large proportion of the total supply required, and the remainder would be generated at the Cavendish Park power house (Barrow), of Messrs. Vickers, Ltd., from whom it would be purchased. In the event, however, of Messrs. Vickers' Cavendish Park power house being acquired by the Barrow Corporation, and transferred to the Joint Authority, the whole of the supply would be generated at these works, and the construction of the proposed hydro-electric station at Backbarrow would be deferred for the time being.

As soon as the financial conditions become favourable for the raising of the money necessary for the construction of a capital station, it is proposed that the Joint Authority should (in the event of Messrs. Vickers' Cavendish Park power house not being acquired) proceed with the construction of a generating station containing two 5,000-kW sets, with provision for the addition of two sets of 10,000 kW each, which would preferably be constructed in Barrow, where for some years a large proportion of the supply for the district would be required, and where a suitable site with an ample supply of water for condensing purposes and good railway facilities is available.

It is proposed to interconnect the generating stations of the Barrow, Lancaster, and Kendal Corporations by means of 33,000-volt, three-phase, 50-period, transmission lines, which will be principally erected overhead, and that 6,600-volt transmission lines shall also be constructed from Lancaster to Morecombe and Heysham; Lancaster to Galgate; Lindale-in-Cartmel to Grange; Lindale-in-Cartmel to Arnside; and Barrow to Dalton.

In view of the urgent need for a supply in certain portions of the district and to avoid extending the generating plant at works which will be shut down when the scheme is carried out, it is suggested that the Board of Trade should, under the powers conferred by Clause 18 of the principal Act, immediately construct the 33,000 and 6,600-volt transmission lines and hand them over to the Joint Authority within two years of its formation.

The Joint Authority shall become the distributing authority for the whole of the district, with the exception of the areas in which the five existing undertakers are already authorised to distribute, in which areas the Joint Authority shall only distribute with the consent of the Electricity Commissioners. In the first instance it is proposed that the necessary work should be carried out for the distribution of electricity in portions of the area only, but should any other constituent authority express a desire for electricity to be distributed within its area, the Joint Authority would extend the transmission lines (or provide isolated plant until such time as an extension of the transmission lines may be desirable), provided that such constituent authority enters into an agreement with regard to the prices to be paid for the supply, and also with regard to the capital required for the work of distribution.

The distribution in all areas not already supplied shall be on the four-wire system, three-phase, 50-periods, at 380 volts for power and 220 volts for lighting and heating purposes. Wherever practicable the existing systems shall be changed over to this system of supply, and large power users will be supplied at 6,600 volts, three-phase.

It is proposed that the Joint Authority should, at a later period, consider the desirability of utilising the generating plant at the National Projectile Factory, Lancaster, the water power which is available at Troutbeck, Kentmere, Eskdale, and the Duddon Valley, and that the waste gases from the blast furnaces in the district should, wherever possible, be utilised for the generation of electricity.

In the appendices to the scheme certain statistical information is given which is summarised below: The total plant capacity in 1920 of the Barrow-in-Furness, Lancaster, Morecambe, Kendal, and Windermere undertakings was 9,260 kW with a maximum demand of 4,627 kW, the kWh sold being 8,360,607. It is estimated that the maximum demand will be 9,930 kW in 1925 and 11,705 in 1930, and that the kWh sold will amount to 20,012,000 and 23,568,000 respectively.

In 1920 a total of 11,220,275 kWh was generated at a consumption of 20,829 tons of coal or 4.159 lb. per kWh. It is estimated that during the first period (1925) of the proposed new scheme 22,176,000 kWh will be generated at a consumption of 22,940 tons of coal or 2.32 lb. per kWh, thus showing a saving of 13,341 tons per annum. Similarly, during the second period (1930) 25,990,000 kWh will be generated at a consumption of 19,232 tons of coal, or 1,658 lb. per kWh, thus showing a saving of 26,915 tons per annum.

The first period of development provides for the erection of a 1,500-kW hydro-electric power house at Backbarrow (about one mile below the foot of Lake Windermere), at which point a weir and headrace already exist, and, by increasing the sectional area and lengthening the latter, a total fall of about 37 ft. will be obtained over a distance of approximately 575 yards. It is proposed to install three 730-b.h.p. turbines to run at 250 r.p.m., and to each of these to couple direct 500-kW alternators to generate at 6,600 volts, three-phase, 60 periods, and by step-up transformers to 33,000 volts, for main transmission. These machines would be run in parallel with those at Buccleuch Street works, and would take as much of the load as the water available would allow. Assuming that approximately 50 per cent. of the water power available is utilised for the generation of electricity, 4,450,000 units per annum would be available for consumption, after making allowance for supplies to the owners of the water rights.

The proposed 33,000-volt main transmission lines will be

* ELEC. REV., Dec. 3rd, 1920; p. 721.

† In the event of the bodies marked thus (†) above failing to agree as to the method of election and/or appointment of their representatives on the Joint Authority, such representatives shall be appointed as follows: By the Lancashire County Council for the first year; by the Westmorland County Council for the second year, and by the Cumberland County Council for the third year, and in the same rotation for each succeeding period of three years. By the Midland Co. for the first year, by the L. & N.W. Railway Co. for the second year, so that each company shall be entitled to appoint a representative every alternate year.

five in number, totalling 48 miles in length, of which nine miles will be underground and the rest overhead; the conductors will be 0.08 sq. in. sectional area. There will also be five 6,600-volt lines, totalling 20.5 miles in length, of which five miles will be underground and the remainder overhead; three of the conductors will be 0.08 and two 0.04 sq. in. sectional area.

The estimated total capital expenditure during the first period (1925) is £287,250, allocated as follows: Main transmission lines, &c. (excluding telephone or pilot wires), £157,250; Backbarrow hydro-electric station (1,500 kW at £40 per kW), £60,000; and distribution (for which constituent authorities will be liable), £70,000. By the end of the second period (1930) the total will have reached £736,850, made up as follows: Main transmission £171,850; hydro-electric station £60,000; Barrow capital steam station (2,000 kW at £20 per kW), £400,000; and distribution, £105,000.

The income and expenditure during the first period (1925) is estimated as under (generation and transmission only, excluding local distribution): Total revenue, £129,000 (20,640,000 kWh at 1.5d.); generation costs, £105,200 (1.223d.); transmission costs, £12,190 (0.142d.); net surplus £7,610 (0.088d.). For the second period the figures are: Total revenue, £160,000 (26,663,000 kWh at 1.44d.); generation costs, £120,600 (1.086d.); transmission costs, £27,320 (0.245d.); net surplus, £12,080 (0.109d.).

The above figures may be compared with the financial statistics of the existing undertakings for 1920 which are: Total revenue, £96,808 (8,360,607 kWh at 2.779d.); cost of production, £105,316 (3.023d.); net deficiency, £8,508 (0.244d.).

The North-West Midlands Scheme.

The draft scheme for the constitution of a Joint Electricity Authority for the North-West Midlands Electricity District that has been submitted to the Electricity Commissioners, and which is abstracted below, was prepared by a Conference of Authorised Undertakers in the district, the chairman of which is Mr. S. T. Allen, chief engineer of the Wolverhampton Corporation electricity undertaking, and the hon. secretary Mr. F. E. Warbreck Howell.

It is proposed that the area provisionally delimited by the Electricity Commissioners* shall be modified by the inclusion of so much of the county of Worcester as is included in the borough of Stourbridge and the urban districts of Lye and Wollescote, and so much of the county of Stafford as is included in the urban district of Rowley Regis. Further, it is desired to exclude from the area so much of the county of Chester as is included in the municipal boroughs of Congleton and Macclesfield; the urban districts of Alsager, Ballington, Buglawton, Sandbach, and Yeardsley-cum-Whaley; and the rural districts of Congleton, Disley, and Macclesfield, and so much of the county of Derby as is included in the urban district of New Mills and the rural district of Mayfield.

The members of the Joint Electricity Authority may or may not be members of the undertakers who appoint them, and each undertaker shall appoint one or more representatives in accordance with the gross revenue of the undertaker—namely, up to £20,000, one member; between £20,000 and £50,000, two members; between £50,000 and £100,000, three members; between £100,000 and £150,000, four members; between £150,000 and £200,000, five members; and for each additional £100,000, one member. The voting power will also be in accordance with the gross revenue of the undertaking—namely, up to £20,000, one vote; between £20,000 and £40,000, two votes; and for each additional £20,000, or part thereof, one vote.

The Joint Electricity Authority shall have power to borrow money for the purposes of its scheme, and the following technical provisions are not intended to be binding, but may be varied at any time with the approval of the Electricity Commissioners. The system of supply to be adopted will be 3-phase, 50-cycle, a.c., the generated pressure to be from 6,000 to 6,600 volts; the main transmission pressure from 30,000 to 33,000 volts; and the secondary transmission pressure from 6,600 to 11,000 volts.

It is proposed that arrangements shall be made in pursuance of Section 13 of the Act to transfer to the Electricity Authority, upon terms which are now under consideration, the following generating stations:—

Ocker Hill, Tipton, Staffs., belonging to the Midland Electric Corporation for Power Distribution, Ltd. Stafford, belonging to the County Borough of Stafford. Park Road, Hanley, Staffs., belonging to the County Borough of Stoke-on-Trent. Birchills, Walsall, belonging to the County Borough of Walsall. Black Lake, West Bromwich, belonging to the County Borough of West Bromwich. Commercial Road, Wolverhampton, belonging to the County Borough of Wolverhampton. And the other existing stations in the district to be transferred later as and when determined by the Electricity Authority, viz.:—

Shrewsbury, belonging to the County Borough of Shrewsbury. Newcastle-under-Lyme, belonging to the Borough of Newcastle-under-Lyme. Leek, Staffs., belonging to the Urban District Council of Leek. Market Drayton, belonging to the Market Drayton Electric Light & Power Co., Ltd.

It is not considered desirable that any of the existing generating stations should be shut down immediately, but that they should be continued so long as economic conditions justify. After the interlinking transmission cables or lines have been laid or erected and the economic conditions warrant it, all the existing d.c. generating stations and plant, and later, when necessary, the more uneconomical of the existing a.c. station plant, will be shut down.

The scheme provides for the erection of three new capital generating stations, one near Rugeley on the river Trent, having an ultimate capacity of 80,000 kW, the second near Ironbridge on the river Severn, having an ultimate capacity of 150,000 kW, and the third on the river Trent near Stone, having an ultimate capacity of 30,000 kW.

The Electricity Authority will make provisions for the supply in bulk, on terms to be arranged, to the two small tramway generating stations situated at Stoke-on-Trent and belonging to the Potteries Electric Traction Co., Ltd., and for adequate supplies to be provided from the main transmission system for the railway companies for traction and railway purposes when required.

The Electricity Authority may utilise, as far as it is economical and expedient, such water power resources as may be available.

* Elec. Rev., Sept. 17th, 1920; p. 370.

LEGAL.

Electrical Apparatus Co., Ltd., v. J. Concord & Co., Ltd.

At Lambeth County Court on Monday, plaintiffs brought an action against defendants, engineers, of Balm Road Mills, Leeds, claiming the return of £97 15s., the price of a Concord improved inclinable power press, No. 19. They pleaded that there was an implied condition in the sale of the press that the machine was in all respects made of sound castings and materials and parts, but that the machine did not comply with the conditions, as there was a latent flaw in the frame which caused the press to break.

A good deal of evidence was heard, including that of Mr. E. A. Chell, managing director of the Rodney Iron Foundry, Ltd., Walworth, who said the broken part had undoubtedly been welded at some time during its manufacture, though he did not believe it had been broken in two parts.

Mr. Frank W. Ward, for the defence, said he was managing director of Burton, Griffiths & Co., Ltd., machine tool makers. There was some evidence of welding in the broken part of the frame. It was on the inside, but he did not think the piece had been broken in two before it was welded. He was of the opinion that the press was not capable of doing the work which it was set to do. Another press should have been used for flattening the brass pieces. It was not strong enough to stand the concussion, and if two pieces of brass slipped in, there would be a fracture. This was not an uncommon kind of accident, and he had known of three or four similar ones.

Judge Parry said he had formed the opinion that the press was sent out with a welded casting, and that it was unfit for the purpose for which it was designed. He was surprised at the amount claimed by plaintiffs, as they could have asked for more damages for the loss they had sustained through the machine breaking down. He gave judgment for plaintiffs for the £97 15s. claimed, with costs.

Marconi Wireless Patents.

A verdict in favour of Marconi's Wireless Telegraph Co., Ltd., and the Compania Nacional de Telegrafia Sin Hilos has been given in the Spanish Courts as the result of a joint action brought by these companies against the Compania Iberica de Telecomunicacion for infringement of patents relating to thermionic valves. The award nullifies certain "Telecomunicacion" patents known as the "Deforest Audion"; requires the defendants to hand over to the plaintiffs all materials manufactured under the patents concerned; and orders the payment by the Telecomunicacion Company of an indemnity to be fixed.

Electrification Scheme in Czecho-Slovakia.—A scheme involving the construction of a barrage 70 metres in height at Stechovice, near Prague, has been submitted to the Minister of Public Works. This barrage, situated 30 kilometres south of Prague, would produce over 250 million kW-hours a year, and would save Czecho-Slovakia 60,000 wagons of coal. The realisation of this scheme would cost from 250 to 300 million crowns. All organisations concerned in Central Bohemia, notably the Chamber of Commerce at Prague, the Agricultural Board, and the Federation of Czecho-Slovak Industries, support the project, which has attracted the attention of many foreign engineers and financiers. It is stated that the electrification of Central Bohemia and the improvement of the Vltava as a waterway will completely alter the economic situation of that region. The first essential to economic development in Czecho-Slovakia is the increase of national output, especially as regards agricultural produce. With this end in view, a scheme should be drawn up for the rational utilisation of the hydraulic resources of the country, and for the investigation of kindred problems; the realisation of the barrage scheme at Stechovice would mean a considerable advance in this direction.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

19,877. "Guides for trolley heads for electric traction." W. Peake. July 25th.
19,896. "Long-distance electric power transmission with underground cables." A. M. Taylor. July 25th.
19,908. "Sound transmitters." F. A. Watkins. July 25th.
19,914. "Means for registering telephone calls." W. Clark, Clark's Neo-electric Devices, Ltd., and E. H. Kinnard. July 25th.
19,915. "Appliance for recording telephone calls and/or amount chargeable." H. G. Cocks, and E. R. Royle. July 25th.
19,916. "Magnetos." P. Courtot. July 25th. (Belgium, July 26th, 1920.)
19,917. "Duplex, &c., telegraphic systems." H. W. Sullivan. July 25th.
19,928. "Incandescent electric lamps." A. J. Barnett and F. H. Eeles. July 25th.
19,930. "Electrical circuit breaker for vulcanising apparatus." A. Ludi. July 25th. (Switzerland, July 24th, 1920.)
19,937. "Electric hand drills." I. Sweetland. July 25th.
19,940. "Compensation of electric networks." Akt. Ges. Brown, Boveri et Cie. July 25th. (Switzerland, July 31st, 1920.)
19,942. "Electric cables." L. R. Lee. July 25th.
19,947. "Electric cables." L. R. Lee. July 25th.
19,954. "Electric magnetic control systems." British Thomson-Houston Co., Ltd. (General Electric Co.) and General Electric Co. July 25th.
19,961. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 25th. (United States, January 11th.)
19,971. "Portable electrical power machine stand." H. E. Dickerson and A. H. Gillborn. July 26th.
19,991. "Electric selective switches for automatic telephone exchanges, &c." C. W. Wilman. July 26th.
19,996. "Devices for avoiding glare from electric lamps of automobiles, &c." Butlers, Ltd., and A. Reeves. July 26th.
19,997. "Electric filament lamp holders." W. W. R. F. Griffiths. July 26th.
19,999. "Electric accumulator boxes." C. R. D. Pritchett, Pritchett & Gold, and E.P.S. Co., Ltd. July 26th.
20,054. "Electric switches." J. W. Tennant. July 26th.
20,059. "Storage battery electrolyte." F. de W. Cheney. July 26th.
20,069. "Dry batteries." Ever Ready Co. (Great Britain), Ltd. (Hoka Electrotechnische Fabrik Ges.) and Hoka Elektrotechnische Fabrik Ges. July 26th.
20,082. "Diaphragms, sound plates, and amplifiers of gramophones." J. W. Barstow. July 26th.
20,096. "Electric switches." W. L. Barber and Midland Electric Manufacturing Co., Ltd. July 27th.
20,114. "Suspension of electric light fittings from overhead conductors." H. C. Busbridge. July 27th.
20,117. "Locking electric lamp bulbs to their sockets." C. A. Ely. July 27th.
20,127. "Carton boxes for holding electric lamps." A. A. Brown. July 27th.
20,178. "Apparatus for making and breaking electrical circuits in submersible bodies." E. Ceano Vivas. July 27th.
20,183. "Voltage regulating systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 27th.
20,186. "Electric battery lamp." M. L. Kaplan. July 27th.
20,202. "Electrically illuminated advertising devices." H. S. Coleman. July 27th.
20,218. "Apparatus for cooling central electrode of ignition plug of air-cooled internal-combustion engines." E. D. H. Robinson. July 28th.
20,219. "Electro-magnetic vehicle coupling." G. Johnston. July 28th.
20,230. "Girder attachment for electrical conduits, gas, or water pipes, &c." E. Laycock and H. Laycock. July 28th.
20,243. "Electrically heated kettles, &c." C. Kratt. July 28th.
20,244. "Electrically operated water heaters." C. Kratt. July 28th.
20,254. "Electrolytic oxidising or reducing substances." C. J. Thatcher. July 28th.
20,266. "Telephones operated by heat." L. B. Miller. July 28th.
20,271. "Electric heating devices." M. Buiskool, H. J. W. Hamers, and W. J. Sillman. July 28th.
20,273. "Machine for recording telephone calls." C. A. Harcourt. July 28th.
20,280. "Electric switches." H. Lucas, O. Lucas, and W. C. Turner. July 28th.
20,281. "Terminals or connections for electric circuits." W. H. Eggington and H. Lucas. July 28th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

4,353. "High-tension rectifiers." Moller. February 25th, 1914.
5,544. "Method of interconnecting lines by electro-mechanically controlled switches." Baron (Aldendorff). (Addition to 28,833, 1913.) March 4th, 1914.
9,285. "Method of and connections for tuning antennæ to a plurality of electric waves which are independent of one another." Mellersh-Jackson (Otto Scheller and C. Lorenz Akt-Ges.). April 14th, 1914.
10,869. "Dynamometers and brakes." Zoller & Schaster. May 2nd, 1914.
12,048. "Control or regulation of motors." Vulcan Werke Hamburg Und Stettin Akt-Ges. (Addition to 12,035, 1914.) March 3rd, 1914.
14,380. "Regulation of alternating or three-phase current generators." Voigt & Haeffner Akt-Ges. June 16th, 1913.

1915.

5,342. "Receiving arrangement for wireless telegraphy." Ges fur Drachtlose Telegraphie. April 9th, 1914.
7,358. "Receiving arrangement for wireless telegraphy." Ges. fur Drahtlose Telegraphie. (Addition to 5,342, 1915.) May 30th, 1914.
10,669. "Telephonic sound reproducing apparatus." Stille. (Addition to 9,644, 1913.) July 22nd, 1915.
14,210. "Construction of detectors for use in submarine sound-receivers." Signal Ges. October 7th, 1914.

1916.

6,887. "Electrically actuated devices especially applicable to electric alarms." J. R. Quain. May 13th, 1916. (166,148.)
13,237. "Telephone systems." R. C. M. Hastings. September 18th, 1916. (166,150.)

1917.

1,515. "Frequency changers and generators of alternating electric current." N. Oboukhoff. January 30th, 1917. (166,156.)
17,872. "Telephonic apparatus." I. Berliner, S. Berliner, and A. Berliner. December 3rd, 1917. (166,178.)

1918.

2,047. "Dynamo-electric power transmission systems." A. H. Neuland. February 5th, 1918. (166,181.)
2,543. "Device for suppressing earth current in high-voltage systems." Allgemeine Elektricitats Ges. January 23rd, 1917. (113,451.)
4,117. "Wireless signalling systems." J. H. Hammond. March 17th, 1917. (158,200.)
6,432. "Electric cells." W. H. Exley and H. Leitner. November 18th, 1918. (166,186.)
9,642. "Instrument for the rapid and exact measurement of capacity and the calibration of electrical condensers." J. Scott Taggart. June 12th, 1918. (166,189.)

1919.

8,215. "Vacuum tubes having an incandescent cathode." Soc. Anon. Des Etablissements H. Pillon. April 20th, 1918. (125,945.)
8,388. "Electro-magnetic devices for use with alternating currents." Switchgear & Cowans, Ltd., D. H. Ogley, and G. H. Neep. April 3rd, 1919. (166,213.)
8,669. "Electric incandescent lamps." D. W. Hogan. April 5th, 1919. (166,215.)
12,610. "Wireless telegraphy." J. J. Aurynger. May 20th, 1919. (166,223.)
12,939. "Alternator for high-frequency currents." H. Antranikian. May 22nd, 1919. (166,224.)
18,651. "Full-wave vacuum tube oscillation detectors." J. Scott-Taggart. July 28th, 1919. (166,237.)
19,498. "Thermionic devices for wireless telegraphy and telephony." H. J. Round. August 7th, 1919. (166,241.)
19,953. "Commutators or distributors for use in connection with electrical ignition systems and for analogous purposes." F. W. Baker. August 14th, 1919. (166,243.)
20,412. "Rotary interrupters for magneto-electric ignition apparatus." Ruthardt & Co. March 19th, 1919. (140,362.)
22,414. "Switchgear for controlling electric motors." J. A. Hirst and P. S. Brook. September 12th, 1919. (Cognate applications 23,453, 1919, and 19,837, 1920.) (166,256.)
22,790. "High-frequency dynamo-electric machines." A. M. Glass (C. Lorenz Akt.-Ges.). September 16th, 1919. (166,259.)
22,863. "Electron discharge devices especially for use in wireless communication." J. Scott-Taggart. September 17th, 1919. (166,260.)
23,681. "Current motors." R. O. C. Hurst. September 26th, 1919. (Cognate application 28,343, 1919.) (166,264.)
24,027. "Electric storage batteries." E. C. R. Marks (Koehler Manufacturing Co.). October 1st, 1919. (166,267.)
24,028. "Electrical system of train communications." E. C. R. Marks (Macfarlane Communications Corporation). October 1st, 1919. (166,268.)
24,114. "Electric lamps." E. C. R. Marks (Koehler Manufacturing Co.). October 2nd, 1919. (166,269.)
24,815. "Electric heating apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). October 10th, 1919. (166,276.)
24,831. "Dry battery cells." Portable Electric Current Patents Co. October 10th, 1918. (133,707.)

1920.

726. "Electrical cut-out or circuit breaker." W. H. Illingworth. January 9th, 1920. (Cognate application 14,413, 1920.) (166,286.)
1,375. "Cableways." Ropeways, Ltd., and E. Roe. January 15th, 1920. (166,292.)
4,275. "Transmitters for wireless telegraphy and telephony." A. K. Macrorie and G. Shearing. February 11th, 1920. (166,300.)
4,314. "Sparking plugs for internal combustion engines." P. R. Cartwright and E. T. Glanville. February 12th, 1920. (166,301.)
7,519. "Means for securing the ends of electric cables." R. S. Woods. March 13th, 1920. (166,311.)
8,709. "Construction of magnetos for ignition purposes." E. A. Layton Smith. March 25th, 1920. (166,314.)
9,389. "Electro-magnetic induction micrometers." J. M. Ford. March 31st ,1920. (166,317.)
9,483. "Compound anode for electro plating and methods of making the same." C. R. Dean. December 12th, 1917. (141,073.)
9,884. "Electric soldering apparatus." E. Martin. April 8th, 1920. (141,367.)
10,216. "Automatic telephone exchange systems." L. Turcat. March 6th, 1919. (141,710.)
10,373. "Distributing arrangements for use in connection with telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and R. Mercer. April 14th, 1920. (Cognate application 29,154, 1920.) (166,351.)
10,549. "High-frequency electrical signalling." Western Electric Co., Ltd. August 21st, 1915. (141,732.)
10,551. "Wireless telephone transmitters." A. R. Taylor. April 15th, 1920. (Cognate application 21,354, 1920.) (166,358.)
10,944. "Electron discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.) April 20th, 1920. (166,365.)
11,516. "Armatures of magnetos." L. E. Brunner and P. J. M. Lefevre. April 26th, 1920. (166,373.)
11,617. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. April 27th, 1920. (166,375.)
11,819. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. April 28th, 1920. (166,378.)
11,888. "Electrical indicators for railway signal and other lamps." A. L. Welch (legal representative of W. H. I. Welch, deceased). April 29th, 1920. (166,379.)
11,904. "Duplex and multiplex telegraphy." B. Davies and Eastern Telegraph Co., Ltd. April 29th, 1920. (166,380.)
12,312. "Telephone systems." Western Electric Co., Ltd. May 5th, 1919. (142,822.)
12,701. "Process for the manufacture of perborates by electrolysis." H. G. C. Fairweather (Fredriksstad Elektrokemiske Fabriker Aktieselskabet). May 7th, 1920. (166,396.)
13,622. "Operating handles of electrical resistance boards or frames, switchboards, and the like." Hockley Chemical Co., Ltd., and F. V. Breeden. May 18th, 1920. (166,407.)
13,775. "Electrolytic separation of metals." C. Langer. May 19th, 1920. (166,409.)
14,415. "Electrically heated vessels such as kettles." W. W. Soutter. May 27th, 1920. (166,416.)
14,636. "Dynamo-electric machinery." M. Walker and Metropolitan-Vickers Electrical Co., Ltd. May 28th, 1920. (166,423.)
17,060. "Radiators or liquid coolers applicable especially to electric transformers." Pressed Metal Radiator Co. November 27th, 1916. (146,131.)
19,052. "Electric pushes." E. A. Graham. July 6th, 1920. (166,446.)
20,408. "Electric arc lamps." Optische Anstalt C. P. Gorerz Akt.-Ges. June 11th, 1919. (148,453.)
21,040. "Manufacture of armatures of electric rotating machines." T. Tanaka. July 11th, 1919. (149,251.)
24,473. "Ejector devices for withdrawing condensate from a condenser." Metropolitan-Vickers Electrical Co., Ltd. September 12th, 1919. (150,998.)
30,267. "Secondary electric batteries or accumulators." H. Dean and Chloride Electrical Storage Co., Ltd. October 26th, 1920. (166,478.)
30,410. "High potential electric condensers." Dubilier Condenser Co., Ltd. March 7th, 1919. (Divided application on 140,046.) (153,027.)
30,564. "Electrode for arc welding and like purposes and method of making same." W. H. Boorne. October 28th, 1920. (Addition to 132,354.) (166,479.)

1921.

10,141. "Electrical switchboards." Metropolitan-Vickers Electrical Co., Ltd. April 23rd, 1920. (162,247.)
15,118. "Apparatus for the separating of suspended bodies from electrical insulating gaseous fluids." E. Moller. July 31st, 1914. (Divided application on 11,088, 1915.) (164,014.)
15,327. "Alternating current electricity meters and the like." S. Z. de Ferranti, G. Wall, and Ferranti, Ltd. January 17th, 1920. (Divided application on 165,133.) (166,500.)